PB-227 962

THE COST OF CLEAN WATER AND IT'S ECONOMIC IMPACT. VOLUME III. SEWERAGE CHARGES

Federal Water Pollution Control Administration
Washington, D. C.

10 January 1969

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THE COST OF CLEAN WATER AND ITS ECONOMIC IMPACT

Volume III

SEWERAGE CHARGES

March 3, 1849

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U. S. Department of the Interior
Federal Water Pollution Control Administration

January 10, 1969

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March 3, 1849

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

The report

1969

Dear Mr. Chairman:

This transmits our complete report on sewerage charges, in response to the Senate Committee on Public Works' request for such a study. That request was contained in Senate Report No. 1370, dated July 8, 1968.

The sewerage charge study has been included as Volume III, Sewerage Charges, in a four-volume report to the Congress, The Cost of Clean Water and its Economic Impact. Volume III addresses itself to methods of financing wastewater collection and treatment systems and discusses the considerations pertinent to the selection of a user charge program by local governmental units as a means for raising needed revenues. Based upon a hypothetical model approach, the impact of various user charge methods on each of several classes of users of wastewater systems is analyzed. The findings of this report support the application of user charges to finance a portion of the costs of sewage collection and treatment systems. The choice of the most favorable user charge method should be made on an individual basis by the local governmental unit concerned due to the myriad factors to be considered in such a choice.

Volume I, The Report, updates our 1968 analysis of costs contained in the first report, The Cost of Clean Water, submitted to the Congress last year. The 1969 report recognizes the progress made in providing waste treatment for sewered communities while pointing up the need for continuing high levels of investment in upgrading, expanding, and replacing the capital base which has been provided. It concludes that the current and expected short-run rate of investment in municipal waste treatment facilities is inadequate to meet water quality improvement requirements by 1973. Although industrial expenditure data are sketchy, they indicate that, in general, industry has a correspondingly more adequate rate of investment in wastewater treatment facilities.

Volume II, Appendix, provides supporting summary data from the 1962 and 1968 Federal Water Pollution Control Administration Municipal Waste Treatment Inventories, and the State water quality standards implementation plans. In addition, the Appendix contains State and industrial comments on the 1968 report.

A fourth volume is an industrial waste profile of the organic chemicals industry which was prepared by several well-qualified firms in the industrial water pollution control field. The profile includes (1) a five year projected range of cost estimates for attaining various levels of water pollution control by this important industry sector and (2) improved methodology for projecting treatment cost estimates for other industries.

We feel that the work reported on here is a significant step forward in the understanding of the economic aspects of water pollution control.

Sincerely yours,

Assistant Secretary of the Interior

Hon. Jennings Randolph
Chairman, Committee on Public Works
United States Senate
Washington, D.C. 20510

Enclosure

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INTRODUCTION

In the post-war period the rate of increase in State and local expenditures has exceeded both the rate of increase in Federal expenditures and the percentage increase in Gross National Product.(1-5) To partially meet this large increase in expenditure, State and local governments have raised the rates of existing levies and introduced new taxes and charges. In spite of these increased revenue efforts, revenues have not generally kept pace with expenditures at the State and local level. Resulting deficiencies in available funds either have been covered by larger Federal grants or have resulted in increased State and local debts.

Although some studies indicate that this revenue gap may shrink in the next decade, many municipalities will continue to experience large deficits unless Federal and State grants are increased. The reason for these deficits is twofold. First, expenditures are increasing because of greater urbanization and increased demand for more and better local public services. Urban renewal, fire and police, water, sewer, and public welfare costs all continue to rise at a fast rate. Second, at the same time that such expenditures tend to increase faster than income, it is difficult for municipal revenues to keep pace with income. This is partly attributable to the fact that real property tax is the main source of revenue. The base of this tax is shrinking in many municipalities because of a migration to the suburbs. As a result, the yield of the property tax, at constant mill rates, tends to be less responsive to increases in income than any of the other major sources of State and local revenue.

Many municipalities are facing increased resistance from taxpayers to new taxes and/or increases in existing levies. In addition, municipalities are unable to use some levies because the administration of them is too difficult or because their use is prohibited by the States. Municipalities are also running into financial, political, and legal limits on increases in debt.

Given these difficulties in raising additional revenue and the level of the debt, some municipalities have placed

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(1) Numbers in parentheses refer to references cited on pages 98-103. The description of the fiscal position of municipalities is based on references 1 through 5.

greater emphasis on service charges. In addition to being more acceptable politically than taxes in some municipalities, service charges are superior to taxes from the viewpoints of equity and economic efficiency grounds in many cases.

As indicated in Volume 1 of this report, municipalities will face significant expenditures for providing sewage service. These large expenditures will likely require municipalities to seek additional sources of revenue. One possible source of additional revenue is a charge on sewer users. Although sewer user charges have been in existence for several decades, recently there has been increased interest in them. President Johnson advocated the use of them in his 1968 Congressional Message on Conservation and Water Management.(6) Professional organizations are also interested in the topic. For example, the American Public works Association, the American Society of Civil Engineers and the Water Pollution Control Federation are preparing a joint report on the financing of wastewater systems.

The purpose of this volume of The Cost of Clean Water and its Economic Impact is to examine the role of user charges in the financing of sewer services. The analysis covers many topics but special attention is given to the following three questions: (1) What is the current position of user charges?; (2) What proportion of capital and operating costs should be covered by user charges?; (3) How should the revenue required to pay for the user share of the costs be distributed among categories of users? Although precise answers cannot be given to these latter two questions, the analysis indicates the solutions which would result from the implementation of various theories or points of view.

OUTLINE

The first section is devoted to describing the current position of user charges in municipalities. First, a brief history of user charges is given, including an explanation of why municipalities have adopted these levies. Second, the types of user charges are described and some quantitative information is presented regarding the frequency of use of the various charge methods. Third, joint treatment of industrial and municipal wastes is discussed. Municipal restrictions and surcharges on industrial wastes are given particular attention. Fourth, the revenue obtained from user charges and the relationship between costs and user charge revenue is described.

In the second section, the division of sewerage costs between users and nonusers is discussed. First, the nature of the sewerage service is analyzed to determine whether a case can be made for employing user charges. Next, various theories and points of view regarding the distribution of cost between users and nonusers are described. The allocation of the nonuser share of costs among categories of nonusers is then examined.

The third section takes up the question of allocating the user share of the costs to the various categories of users. General criteria or tests that can be applied against user charges are described. These tests are equity, economic efficiency, administrative simplicity and revenue adequacy. Various charge formulas that are currently employed or which have been suggested are analyzed in terms of these tests. Then, using a comparatively large city in the Eastern U.S., the distribution of revenue burden that would be assigned to the residential, commercial, and industrial sectors of the municipality under various charge formulas is computed. Finally, the impact of user charges on the distribution of income is discussed.

SOURCES OF INFORMATION

The description of user charges is based primarily on studies conducted by the American City Magazine, the Municipal Finance Officers Association of the United States and Canada, the American Public Works Association and 21 State reports. Most of the State reports are based on surveys conducted by the League of Municipalities in the respective States. Unfortunately, these data sources do not give an up-to-date picture of user charge practices. The studies were undertaken by different groups for different purposes at different times. Comprehensive studies were conducted by the American Public Works Association but, unfortunately, the studies are more than 13 years old. The other general studies, based on smaller samples, were conducted over eight years ago.

The reports vary widely Not only do they differ in terms of the date of the survey, and the proportion of municipalities sampled, but also in the questions asked and the method of presenting the results. Because reports are not available for more than half of the States and because the information is so varied in the reports which were obtained, State comparisions are omitted. 1/ Thus, the description of user charge practices does not have the desired degree of precision and, in a few instances, the material may be out-of-date.

The Federal Water Pollution Control Administration is attempting to provide up-to-date data on user charges by supporting a comprehensive survey of municipalities on this topic. More than 2,000 local government units will be surveyed and the questionnaire is being designed to provide information on major questions relating to charges. However because of the time involved in developing a satisfactory questionnaire, conducting the survey, and tabulating, summarizing, and analyzing the survey results, the report based on the survey will not be available until later.

Data for the model that illustrates the proportion of total user revenue that would be paid by various groups of users under different charge formulas were obtained from diverse sources. Water consumption, residential property assessment values, and number of industrial employees were obtained from Hittman Associates, Inc. of Columbia, Maryland. Information on BOD per industrial employee was supplied by the FWPCA Ohio Basin Region, Cincinnati, Ohio. Commercial property assessment values and part of the information regarding industrial assessment values were obtained from the Department of Assessment in Baltimore, Maryland. The number of commercial establishments was obtained from the 1963 Census of Business, U.S. Department of Commerce. The number and property value of industrial firms were taken from the U.S. Department of Commerce, 1963 Census of Manfactures.

DEFINITIONS

User Charges - Several definitions of user charges could have been utilized in this discussion. One view is that user charges include all taxes and charges that are utilized in paying for sewers. Another view is that user charges include only the charges that are related to the degree of use of the sewer system. The definition adopted here is that user charges include all levies that are designated as sewer charges by the municipalities. Thus where there are no designated user charges, and sewer costs are financed from special

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1/ Summaries of the State reports are given on a State by State basis in the appendix.

assessments and property tax proceeds, municipalities are classified as not employing user charges. User charges do include levies that are not related to the amount of sewer use, such as a flat monthly charge as long as the municipalities label them as applying to the sewerage system.

Users and Nonusers - Users normally discharge wastes into the sewer system. They are often subject to charges designated as sewerage charges by municipalities. Nonusers include those who may obtain some benefits from the sewerage system and who may pay for part of the sewerage costs, but whose contribution is not dependent on discharge of effluent into the system. The most important groups of nonusers are property owners and the general public which is represented by Federal, State, and municipal governments.

Property owners may pay part of the sewerage costs through the general property tax and special assessments. When a special assessment or part of the property tax is earmarked for sewerage purposes, the line between a user charge and a nonuser levy becomes blurred. However, proceeds from special assessments and the property tax, even through earmarked for the sewerage system, are generally regarded as nonuser levies.

The State and Federal Governments may contribute by providing grants, financed from general tax revenue, to municipalities for the construction and operation and maintenance of the sewerage system. Municipalities may cover some sewerage costs from general revenue sources.

Sewerage - Sewerage refers to the entire collection, interceptor, and treatment system.

SUMMARY AND CONCLUSIONS

THE CURRENT POSITION OF USER CHARGES

The description of user charge practices is based on four national studies and 21 State reports. The following conclusions may be drawn from these studies:

1. There are two major types of user charges - - sewer service charges and tap fees. Sewer service charges are monthly or quarterly levies which represent the source of more than 90 percent of the user charge revenue. Tap fees are levied only when a customer is first connected to the sewer system. Although tap fees account for less than 10% of total user charge revenue they may be important in financing construction of the initial sewerage system and of additions for some municipalities.

2. Approximately 70% of the municipalities over 5,000 in population and a substantial number of municipalities below this size employ sewer service charges of some type. Over three-fourths of these municipalities have adopted such charges in the last 20 years. There also are several sewer and utility districts which levy sewer service charges.

3. There are several reasons for the recent growth in the adoption of user charges, the most important of these being: (1) State and local legal limitations on the amount of general obligation debt; (2) limitations on municipal tax sources and on the taxing power of special districts; and (3) a rapid increase in the demand for public services at the municipal level. When user charges are combined with revenue bonds, State and local debts are not normally increased. The financing of sewerage services through user charges therefore allows a municipality to employ its taxing power in meeting the cost of other public services such as education, roads and urban renewal.

4. The formulas used to determine sewer service charges are varied but they can be placed into five general categories: (a) water use, (b) number and type of

plumbing fixtures, (c) uniform flat rate (an identical charge for each customer). (d) modified flat rate(the charge varies by type of customer), (e) size of water meter, and size and number of sewer connections. The most commonly used formula is a uniform or modified flat rate. However, its use is concentrated in the municipalities below 5,000 in population. For municipalities above 5,000 population, approximately 65 percent base the charge on water use. The percentage of municipalities employing a water use charge also appears to be increasing. Many municipalities that base the levy on water use exclude water used for lawn sprinkling from the charge. The number of municipalities that base the entire charge on the number and type of plumbing fixtures, size of water meter and size and number of sewer connections is estimated at less than 10 percent. However, some municipalities levy a minimum charge based on one of these factors and a variable charge on water use.

5. Over 35 percent of the municipalities provide sewerage service to customers residing outside the municipal boundaries and the percentage is probably increasing. Two-thirds of the municipalities that service outside customers charge them 50 to 100 percent more than the customers residing inside the municipality.

6. Nearly all municipalities have provisions in their ordinances that prohibit the discharge of certain wastes into the sewer system. However, there are variations in restrictions and enforcement severity. Most municipalities do not require pretreatment.

7. Approximately 100 to 200 out of the largest 3,000 municipalities levy a surcharge on industries that discharge effluents of above average pollutant levels. The charge is commonly based on biochemical oxygen demand and suspended solids but acid concentration and chlorine demand are also included in some formulas. Many of the cities which have employed these surcharges indicate that such charges have had some impact on reducing the volume and the strength of effluents discharged by industries.

8. The annual per capita yield from sewer service charges ranges from less than $1 to over $60 but the average yield is estimated at $7, excluding municipalities that levy a uniform flat charge. The annual per capita yield where a uniform flat rate is used is about $5.

9. Statistics relating user charge revenue to sewerage costs are sparse, but it is likely that over two-thirds of the municipalities employing user charges more than meet the operation and maintenance costs of the sewerage system from this revenue source. In Texas, for which the most extensive data were available, user charge revenue exceeds operation and maintenance costs for more than 90% of the municipalities employing user charges. It is likely, however, that less than one-third of these municipalities obtain enough revenue from user charges to meet both operation and maintenance and debt service costs. The ratio of revenue to costs appears to be the smallest for municipalities below 5,000 and above 500,000 in population.

10. Sewerage charges as a revenue device must be considered within the context of total local government expenditures for all purposes. In spite of increased revenue efforts by State and local governments, revenues have not generally kept pace with expenditures. The income shortage has been covered by larger Federal grants and increases in State and local debts greater than increases in gross national product. The waste treatment cost covered by local governments is usually local cost after deducting State and Federal grants; thus the revenue to cost picture presented is even less clear in this light. The ability to finance all costs in the absence of grants is not known.

DISTRIBUTION OF COST RESPONSIBILITY BETWEEN USERS AND NONUSERS

11. In the second section of Volume III, various formulas for dividing sewerage costs between users, (individuals and businesses who discharge wastes into the system) and nonusers (property owners and Federal, State and municipal governments) are discussed. It should be noted that an individual or business may be assessed costs as a nonuser and also as a user if wastes are discharged. One finding is that no matter what opinion one may have about this division of costs he can find a theory to support it because the formulas vary so widely in terms of where the responsibility for the collection and treatment of wastes is placed. However, this report concludes that there is a strong case for dividing the costs between users and nonusers. On this basis, a well-designed user charge

system should not cover all of the total construction, operation, and maintenance costs of a sewerage system.

There are several reasons why users should meet a substantial share of the costs of the sewerage systems. One, users benefit from the collection and treatment of their wastes and it is equitable that they pay for this service. A properly designed user charges system will enhance the equity charteristics by distributing costs in a manner more closely related to service provided than will other ways of raising revenue.

Second, effectively administered user charges can also improve the management of industrial wastes. Charges on volume, and sometimes strength of wastes, can create an incentive for industrial users to pre-treat, change processes and manage wastes more effectively.

Third, user charges provide a relatively stable source of revenue with which to meet sewerage costs which allows for a business-like management of the sewerage system and provides for an orderly expansion and upgrading of the system.

The case for assigning some of the costs to nonusers is less obvious but is no less valid. First, property owners gain from having a sewerage system through an appreciation of property values whether or not they discharge wastes. Second, storm water collection in combined systems and the availability of sewerage service both are likely to have a positive influence on property values. Third, the general public benefits from improved water use, disease control, recreational opportunities and esthetics.

The reports suggest that nonusers should bear a much greater share of capital costs than operation and maintenance costs. However, no exact division of costs between users and nonusers can be specified. Each situation must be examined in terms of the relevant characteristics. For example, property owners should bear a smaller proportion of the costs in areas where storm and infiltration water is unimportant as compared to areas where this water volume is important. Also, policy considerations related to ability to pay and the desired rate of investment for controlling pollution influence the shares borne by higher levels of government. Nor can any universal method of collecting the revenue be specified; there are several types of user charges. On the nonuser side, property owners may meet their responsiblity through a number of means. Often, these costs will be met through special assessments or through the price of property in cases where developers install the sewer system. Sometimes, nonuser costs will be met through general property taxes.

Some of the formulas described in the report do not discuss the role of Federal and State governments in the financing of sewer systems. However, there are several reasons why Federal and State grants should be used in this area. These grants will enable the necessary standard of water quality to be obtained more quickly and will encourage municipalities to plan and construct sewage systems. The grants aid municipalities over the difficult transition period when treatment plants are being constructed, the system is underutilized, user charges have not or cannot be depended upon to cover the costs, large increases in the property tax are politically unacceptable and debt limits are nearly reached. On balance, Federal and State grants coupled with regulatory action have tended to stimulate investments in waste treatment facilities.

THE DISTRIBUTION OF COST RESPONSIBILITY AMONG CATEGORIES OF USERS

12. The third section of the report is devoted to examining various charge formulas in terms of generally accepted tax or charge canons and in terms of the impact on various types of customers and the income distribution. No charge formula is clearly superior to all of the others in terms of equity, economic efficiency, ease of administration, and revenue adequacy. For example, a uniform or modified flat rate charge is the easiest to administer but is deficient in other ways to other types of charges. The so-called Joint Committee Formula (a charge based on the volume and strength of sewage) appears to be a highly equitable system but it is difficult to administer. A charge based on water use scores between the uniform flat rate and the Joint Committee formula when all considerations are taken into account.

13. A model was constructed to measure the impact of different charge formulas on the various categories of users. Users

were classified into residential, commercial, and industrial groups and the charges studied were; (a) a uniform flat charge, (b) a charge proportionate to water volume, and (c) a charge proportionate to biochemical oxygen demand discharges. It is recognized that a uniform flat rate would likely not be used in an actual situation as that modeled; however, it serves to delineate the limits of cost distribution. The amount paid by each user category if sewerage costs were met by the property tax was also computed. Residential users would pay the most under a flat rate and the least under a charge based on biochemical oxygen demand. Industrial users would be in the opposite position. Commercial users would pay the most if costs were covered through a property tax and the least if a flat charge was used.

14. Under any of the charge formulas, the proportion of income paid by an individual in user charges is inversely related to the level of his income. Charges based on water volume and plumbing fixtures are not as likely to widen income differentials as a uniform charge.

15. A municipality, when choosing a charge formula, has to examine the alternatives in the light of its own situation; no general recommendation that can be made at this time would be of much value. In particular, such evaluations must examine the trade-off between administrative simplicity and equity. A water use charge appears to be a good compromise choice if water is already metered; in cases where a variety of industrial wastes form a large part of the sewage brought to a treatment plant, such as may occur in a regional system, a charge based on both volume and strength of waste may be appropriate.

THE CURRENT POSITION OF USER CHARGES

This section of the report describes the current practices of municipalities in regard to user charges.

User charges employed by municipalities can be placed into two main categories of levies. One type of levy is called a sewer service charge or sewer rental and it is generally paid monthly or quarterly. The basis for this levy varies among municipalities. Commonly used bases include: size of the water meter; number of plumbing fixtures; quantity of water purchased; percentage of water bill; and flat rate per period of time.

A second category of levies includes charges that are made at the time the property is connected to the sewer system or when the property changes hands. These charges are generally labelled as connection or tap fees, and inspection fees. The charge may be a flat fee but often it is related to the frontage of the property, the size of the sewer pipe and whether the street is paved.

HISTORY OF USER CHARGES

A large majority of the municipalities with populations of 5,000 or more currently levy sewer service charges. Municipalities with populations below 5,000 also make extensive use of this source of revenue.

From an examination of State reports and other literature, it is estimated that, of the municipalities which responded to various surveys, 70 percent of those 5,000 in population levy sewer service charges and nearly all municipalities charge a tap or connection fee. (19-43) This estimate of 70 percent is higher than estimates made by earlier studies reflecting the growth in the use of sewer service charges in the last decade. The 1953 study estimated that over 30 percent of the local Government units above 5,000 in population levied sewer service charges.(22) The 1962 study by the Municipal Finance Officers Association indicated that 63 percent of the local Government units included in its survey had sewer service charges.(19)

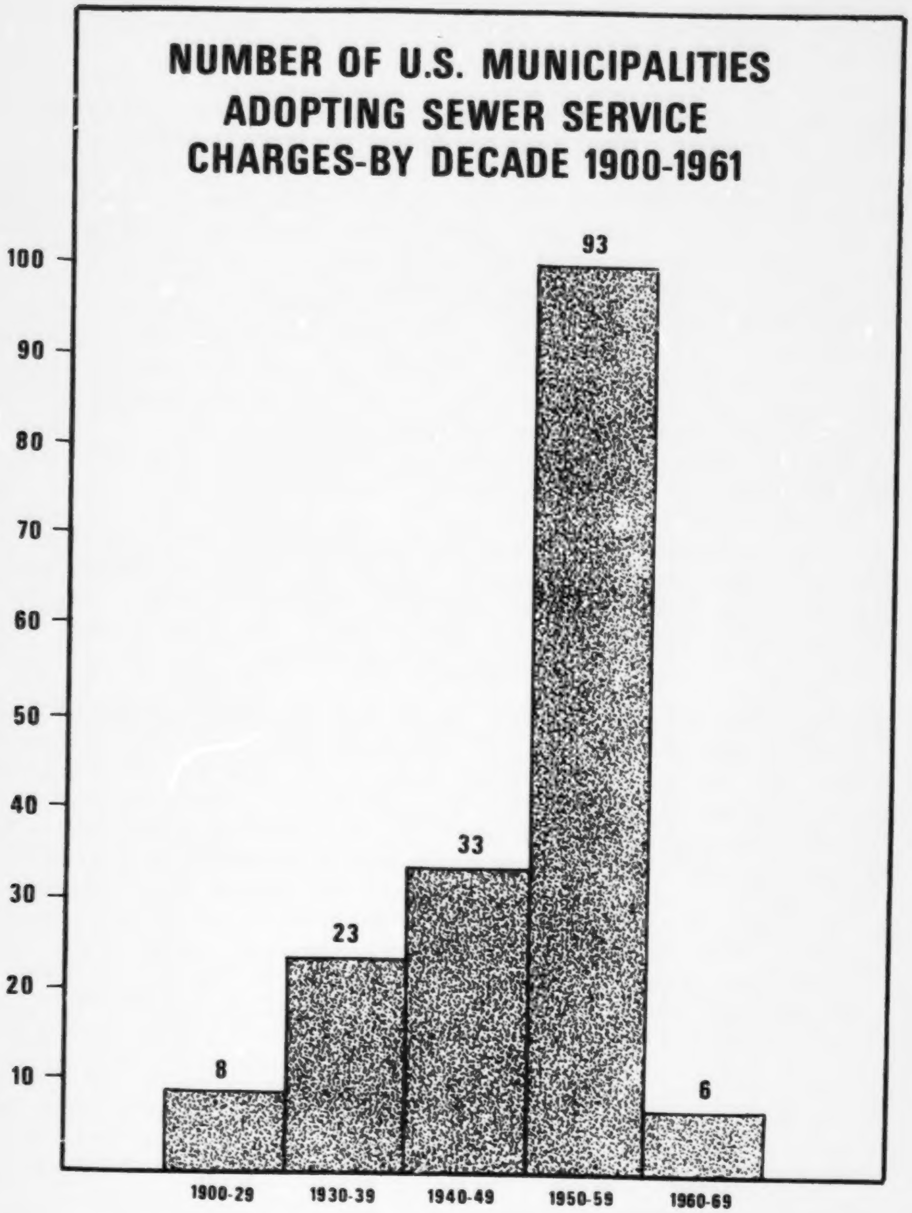
The popularity of user charges is comparatively recent. Although the City of Quebec, in Canada, first levied a charge in 1810 and Brockton, Massachusetts and Boulder, Colorado instituted charges at the turn of the century, very few municipalities employed sewer service charges until the depression years.(19)-(20)

During the 1930-39 period, many municipalities adopted sewer service charges. One reason for the institution of charges was the shortage of revenue experienced by all levels of Government during the depression. Several new charges and taxes were adopted by State and local Governments during this period. A second reason for the rapid growth in charges during this period was that many sewers were constructed in the depression years and user charges were viewed as a method of paying for them. During the war years, there were few charges adopted. After World War II, the rapid growth of nearly all expenditure items at the local level caused municipalities-many for the first time-to insitute new charges and taxes. The additional costs associated with sewage treatment caused part of this growth in the use of charges.

In the 1960-68 period, there was some increase in the number of municipalities employing sewer service charges and many municipalities made changes in the sewer levies. Most of the changes were increases in rates, but in some cases the structure and basis of the charge was altered.

The pattern of sewer charge adoption is demonstrated by the survey conducted by the Municipal Finance Officers Association in 1962.(19) The survey indicates that, of 163 municipalities which gave the date of adoption, 8 instituted charges prior to 1930, 23 during the 1930-39 period, 33 during the 1940-49 decade, 93 during the 1950-59 period and 6 during the 1960-69 period. The rate of adoption by decade is shown in Figure 1. The reason for the uneven growth in the number of municipalities employing sewer service charges is that the pressure for additional revenue came during the depression when revenues declined and in the postwar period when municipal expenditures increased at a rapid rate.

There are several reasons for the recent growth in the adoption of sewer service charges. Many local governments have reached or are approaching the legal limit on the amount of general obligation debt that can be issued. The combining of sewer service charges with revenue bonds allows municipalities to build sewage facilities without affecting the general obligation debt limits. This method of financing sewerage facilities permits municipalities to use general obligation bonds in financing other public facilities, such as schools, where revenue bonds are not generally practicable. Because of debt limitations



NUMBER OF U.S. MUNICIPALITIES ADOPTING SEWER SERVICE CHARGES-BY DECADE 1900-1961

SOURCE: Lennox L. Moak, Sewer Service Charges, Municipal Finance Officers Association of the United States and Canada, Chicago ,1962 municipalities have placed increasing emphasis on revenue bonds in financing facilities other than sewers as well.(17)(18)

Another reason for the recent attention given sewer service charges is that municipalities are often restricted in terms of the tax sources available to them. Special districts are also limited in their taxing power. For example, income and sales taxes often cannot be levied because of legal or administrative limitations. There are also political limits on the revenue that can be obtained from the property tax. With the rapid growth in the demand for public services at the municipal level, these limitations on revenue sources have become more important. Sewer service charges have been a relatively popular way of obtaining revenue. They can be defended on equity ground because they are related to a service received. The increase in sewage treatment has made the relationship between sewerage costs and use of the sewerage system even more apparent. Sewer service charges also have become popular because they often include the entire municipality and substantial amounts of revenue can be raised with moderate rates.

TYPES OF USER CHARGES

The nature, basis, and magnitude of user charges vary greatly among municipalities. Some municipalities employ a complex formula for sewer service charges that includes the type of customer, the number of plumbing fixtures, and the quantity of water purchased. Other municipalities levy a flat monthly charge against all customers. In some municipalities residential customers are charged on one basis and commercial customers on another basis. Similarly, the tap or connection fees vary among municipalities and are based on a combination of frontage, number of connections, and the size of the water meter in some municipalities, and are simply fixed fees in other local units.

Municipalities also differ in the treatment of customers located outside the municipal boundries. Some local government units charge both inside and outside customers at the same rate, while others charge outside customers three times as much as customers located inside the municipalities.

Sewer Service Charges(19-43)

Although municipal sewer charges are based on many different factors and, in some cases, a combination of factors, most of the charges can be grouped into five broad categories. Each category includes several variations of a particular charge method. When all municipalities are considered, the most common levy is a flat charge. This is by far the most frequently used charge method for municipalities below 5,000 population. However, the most frequently used charge in municipalities above 5,000 population is based on water use. This percentage is even higher if only municipalities above 25,000 population are considered.

1. Water Use

The rationale for basing service charges on water use is that sewer costs are related to the volume of sewage and most of the water purchased by a customer eventually ends up in the sewer system. It is generally regarded as the most equitable method of distributing sewer costs by experts in the field. However, it is more complex than most other methods. The popularity of these charges varies among States but, in general, formulas based on water use are most commonly employed by large cities and cities that have large commercial and industrial customers. There is also some evidence to indicate that, on balance, municipalities are replacing other charge formulas with formulas based on water use.

There are many different types of charges based on water use but the two most commonly used formulas involve a percentage of the water bill and the volume of water. In a few cases, a combined sewage and water charge is made. For some municipalities that treat industrial waste the charge is based on both the volume of water and the characteristics of the sewage.

a. Percentage of Water Bill. For municipalities that charge in relation to water use, the most common basis for the levy is a percentage of the water bill. This charge is simpler to compute and easier for customers to understand than a charge based on water volume. It also simplifies billing because the sewer charge can easily be calculated and submitted to customers along with the water bill. The simplicity of this charge method is also a cause of some of its problems. The criteria used in designing the water rate schedule may not be appropriate to use in setting sewer service charges. For example, the water rates may be designed to distribute equitably the operation, maintenance, and capital costs of the water system among the various categories of users. This distribution of costs may not correspond to an equitable division of sewer costs, however.

This problem can be alleviated to some extent by charging a different percentage of the water bill to various classes of customers. However, it is difficult to arrive at the correct percentage for a group of customers and customer reaction is often unfavorable. Few municipalities employ this variable percentage method in practice. Another difficulty with charging in proportion to the water bill is that the percentage must be changed when the water rates are changed if a given amount of sewerage service revenue is desired. This gives an appearance of a change in sewerage charges and is difficult to explain to customers.

The range in the percentage of the water bill selected by municipalities is from 5 percent to 300 percent. Most of the municipalities are in the 50 percent to 100 percent interval. In some municipalities there is a flat sewerage service charge in addition to the variable charge that is based on the water bill. This flat charge is normally less than $2.00 per month and is designed to obtain a fee from customers for having the right to use the sewerage system, independent of the volume or amount discharged.

b. Volume of Water. Municipalities that charge directly on the volume of water purchased utilize one of two types of rate schedules. A small number of municipalities use a flat rate per unit of volume where volume is measured in gallons or cubic feet. A typical charge is $.10 per thousand gallons. This method is simple to compute and easy to understand since it results in a distribution of charges that is proportional to the volume of water purchased. This distribution may not be equitable, however, if sewerage costs are not proportional to the volume of water.

The majority of municipalities that base the service charge on water volume have a rate schedule that varies inversely with the volume of water used, that is, as the quantity of water purchased increases, the rate decreases. All of the rate schedules are in terms of blocks of water but the number of blocks varies. Some municipalities have only two blocks while others have more than eight blocks. The average number of blocks is approximately five and the rate (per thousand gallons) in the first block is generally a little more than twice the rate in the fifth block.

In some municipalities the blocks are identical to the blocks used in computing the water bill and the rates are roughly proportional to the water rates. In these cases, the service charge is similar to a charge based on a percentage of the water bill. Most municipalities, however, have a rate and block schedule that is quite different from the schedule used in calculating the water bill. This charge method does allow a municipality to base the charge on one of the determinants of sewer cost,i.e., water volume. It also permits the rates and blocks to be related to sewerage costs rather than water cost.

c. Combined Charges. A few municipalities make a combined sewer and water charge. This has the advantage of simplifying the billing procedure from the standpoint of the municipality and presenting customers with one bill instead of two. One disadvantage is that the rate schedule is normally geared to water costs and incremental sewerage costs are given little attention. Another possible disadvantage is that customers are not able to make a distinction between the charges for the two services and, consequently, cannot relate the charge to the level or quality of each service.

d. Volume of Water and Characteristics of Sewage. Several municipalities base the charge on the volume of water and the characteristics of the sewage. Charging in relation to the characteristics of the sewage is an attempt to place the extra costs associated with the treatment and disposal of certain types of sewage on the customer discharging the sewage. In most cases, the charge associated with the strength of sewage is in the form of an extra charge or surcharge. It is generally applicable only to businesses which discharge industrial waste that is difficult and costly to treat.

There are some difficulties with each of the charge methods based on water use but, in most cases, satisfactory solutions have been found. One difficulty is that some customers may obtain water that is not metered but is discharged into the sewer system. Generally, this problem is limited to a few customers, usually industrial firms, and is normally solved by installing sewage meters or by estimating the volume of sewage.

Another problem is the water that is purchased by the customer but does not find its way into the sewer system. The most obvious example of this is lawn sprinkling. Another example is the water that becomes embodied in a product during the production process. Allowance is often made for water used in sprinkling by basing the sewer charge on the water used during the winter. For example, a municipality may base the sewer service charge on the average of of the water bills for January, February, and March. Occasionally, the municipalities solve this problem by placing a maximum on the service charge. No adjustment is usally made for water that becomes embodied in the product; nor do municipalities normally charge unpolluted water at a different rate even though they place surcharges on sewage that is above a certain strength. The charging for water that does not reach the sewerage system could be eliminated if sewage meters were installed for all customers. However, this would be a very expensive undertaking and the gain in accuracy would probably not be worth the cost in most instances.

2. Plumbing Fixtures

The number of plumbing fixtures is not a commonly used basis for levying service charges in most States. In a few States, however, it is used by several cities, and in Texas it is the most frequently used charge method. In some municipalities, the charge is based on the type of fixture as well as on the number. It is quite common, for example, to charge more for commodes, garbage disposals, and washing machines in commercial establishments than for other fixtures. Nearly all of the municipalities have a minimum charge that includes a certain number of fixtures. The minimum charge is frequently between $.50 and $3.00 and includes from one to four fixtures.

Municipalities also differ in that some charge a flat rate per fixture and others charge less per fixture as the number of fixtures increases. Typical charges are $2.00 plus $.25 for each fixture over four; or $2.00 plus $.35 for the fifth through the eighth fixture and $.25 for each fixture over eight. A few municipalities base the minimum charge on the number of fixtures and the variable charge on water use.

There are several reasons why a municipality may want to consider basing the service charge on the number of plumbing fixtures. In cases where the municipality would like to base the charge on water use but is prevented from doing so because the water works is privately owned or water is not metered, it may be that the number of fixtures is the best indicator of water use. A second reason is that some of the sewer costs, like the diameter of the pipe, are related to the peak load that can be placed in sewers. The larger the number of fixtures, the larger the demands that can be put on the sewer system at any one time. Consequently, it could be argued that sewer costs should be apportioned according to the number of fixtures. Three, it may be public policy to distribute the burden of sewer costs in a way that favors low income families. The number of fixtures almost certainly increases with family income. A charge based on the number of fixtures is likely to be higher for high income families than a charge based on any of the other commonly used formulas. Fourth, the mix of fixtures gives a rough indication of the characteristics of the effluent discharged into the system. A charge that varies by the type of fixtures can be viewed as a levy that is related to the strength of the sewage.

For each of the advantages there are disadvantages that are generally offsetting. The number of fixtures is at best a very crude measure of water use. Sewer costs are not related to the peak load of sanitary sewage in places where a combined sewer system exists because it is constructed to take storm water as well as sanitary sewage. Peak loads, in any event, are dependent on many factors, only one of which is the number of fixtures. A sewer service charge is a rough tool with which to redistribute income and it is questionable whether a municipality should attempt to redistribute income through a charge based on a service. The type of fixture is also a very crude indicator of sewage strength and it is not clear that any household sewage should be subjected to a special charge. A charge based on the number of fixtures is administratively complex in that frequent inspections are needed to make certain that the charges are up-to-date and accurate. The best case for basing the charge on the number of fixtures appears to be where a measure of water use cannot be obtained.

3. Flat Rate

The most popular form of a sewerage service charge among small municipalities is a flat rate levy where the same amount is charged to each customer. A large majority of the local government units below 5,000 in population employ a uniform flat charge, while large municipalities seldom use such a levy.

Service charges based on a flat rate are paid less frequently and are generally less than charges based on other formulas. The billings are often made on a quartly, semi-annual, or annual basis. When placed on a monthly basis, the rates are generally in the $.50 to $3.00 range. The median charge is approximately $1.00.

Over the past decade, there has been a slight trend toward substituting charge systems based on water volume and type of customer for a flat rate charge. One reason for this is that all sewerage costs have increased and sufficient revenue cannot be obtained from a flat charge on all customers because of the resistance of large increases in rates by owners and renters of single family dwellings. A second reason for the trend toward more sophisticated charge formulas is that waste treatment plants have become more common. The cost of these plants is more directly related to the volume and strength of sewage than is the cost associated with the collection system. A third reason for this trend is that commercial and industrial firms and apartments are becoming larger and increasing numbers of these establishments are being serviced by municipal systems. As a consequence, the inequities resulting from a flat charge are more apparent.

The chief advantage of a flat rate charge method is its simplicity. It does not require any metering or inspections and the billing is simple because the same charge is levied against each customer. On the negative side, the charge is not related to costs, especially treatment plant costs. Where large quantities of effluents are discharged by industrial and commercial firms or large apartment houses, and costs are met by service charges, families residing in single family units are subsidizing these large users of the sewerage system. Thus, since simplicity appears to be its only virtue, the scope and usefulness of a flat charge is limited to very small municipalities that do not have any large users. This is consistent with the current practice; as pointed out earlier, this charge formula is found most frequently in small municipalities.

4. Modified Flat Rate

A sophisticated version of the flat rate charge method is a system where the rate varies by the type of customer. Single family homes may be one type, apartments another, and industries still another. The two systems are very similar in that both charges are a fixed amount per unit of time. In municipalities where there are only two or three customer classes, the difference between the two systems is slight. In many of the studies and reports on user charges, the two methods are placed in one category.

Although there are many similarities between charges based on a flat rate and those based on the type of customer, there also are many differences. The revenue yield is generally higher under the scheme that varies the charge by the type of customer. Increased revenue is possible because rates can be increased for certain user categories while maintaining the standard rates for residential customers. The modified system can take into account the average volume and strength of the sewage discharged by the customers in each category. A detailed customer classification system increases the complexity of the levy, but a charge based on a customer category is easier to administer than one based on water volume and the strength of the sewage. A system with several categories can be more easily adjusted to include new types of commercial and industrial customers with hard to treat wastes than can a flat charge system because the principle of charging different rates to various customers is already established.

The number of customer categories varies greatly among municipalities. In some municipalities there are only three or four categories and in other local units there are over 15 categories. A typical small municipality would have the following monthly rate schedule: single residences-$2.00; apartments-$1.50 for the first unit and $1.00 for each additional unit;

cafes and drugstores- $4.00; service stations- $5.00; schools- $40.00; hospitals- $50.00; creamery- $30.00; others- $3.00. Larger municipalities generally have many commercial and industrial customers and, consquently, have a more detailed classification scheme. A few municipalities base the charge to industrial and commercial customers on the number of employees as well as the type of business.

Basing the service charge on the type of customer has many advantages. The charge system is comparatively simple to administer, the revenue potential is high, and it can take into account the average volume and strength of the effluent of the customers in each category. In terms of charging according to the volume and strength of the sewage, however, this method does have some shortcomings. It is crude in that the charge to the different customer categories may be based on some rule of thumb rather than on an examination of the effluent discharged by that category. The charge may also be inequitable in that all customers in a given category are charged the same amount, even though they may vary in their use of the sewerage system. A fixed charge does not provide any incentive for a customer to reduce the amount or improve the strength characteristics of the sewage. The modified flat charge method appears to be most appropriate where water use statistics cannot be obtained or a water use method is judged to be too complex.

5. Water Meter and Sewer Connections A small number of municipalities base the service charge on the size of the water meter or the number and size of the sewer connections. The reasoning behind these charge methods is similar to that described for plumbing fixtures. The size of the water meter and the size and number of sewer connections indicate the actual and potential use of the sewerage system. Thus, it is argued, costs associated with the average and peak load volumes of sewage can be best distributed in relation to use by charging in relation to water meter or connections. Although this line of argument has some merit, these charge methods are crude. They do not consider the strength of the sewage and they are only a very rough measure of volume. These charges are, however, easy to administer.

Less than five percent of the municipalities use only charges based on the size of the water meter or sewer connections and this five percent is concentrated in the less than 5,000 population category. Some municipalities, including a few above 5,000, have a minimum charge based on the size of the water meter or sewer connections and a variable charge based on water use. A typical schedule of monthly rates for a municipality charging on the basis of the size of the water meter exclusively would be as follows; 5/8" - $1.50; 4" - $50.00; 8" - $100.00; and, 12" - $800.00. The rates charged by most municipalities are similar for the small meters but there are sizeable rate variations for large meters. Monthly service charges based on connections range between $1.50 and $3.00 per connection.

Sewer Connection and Tap Fees

Nearly all municipalities have connection or tap fees. These fees are levied at the time the customer is connected to the sewer system to cover the costs of making the addition to the system. However, the large variation in the charges among municipalities indicates that costs are probably not covered in some places and that revenues exceed costs in other municipalities. Some municipalities levy permit, inspection, and reinspection fees. These inspections are made when the customer is connected to the system, when the property changes hands, and at certain time intervals (e.g., every five years).

As is the case with sewerage service charges, the basis of the connection fees varies among municipalities. The most frequently found levies are flat fees that range from less than $5 in some municipalities to over $400 in others. A common charge is $100. Some municipalities differentiate between commercial and residential customers in setting the connection fee. In most cases, the commercial fee is nearly double the residential fee.

Several municipalities have variable charges and the charge usually depends on one or more of the following factors: (1) the size of the sewer connection or water meter; (2) the frontage; (3) the condition of the street; and (4) the location of the customer. Under these four conditions, the highest charges would be levied against a customer who has a large lot, and lives on a paved street outside the boundries of the municipality.

In some municipalities that base the charge on the size of the sewer connection, the rate varies from less than $5 for a four-inch sewer to over $1,000 for a twelve-inch sewer. Where the amount of frontage affects the fee, a charge of between $2.00 and $4.00 per foot is common. If pavement must be broken and replaced, the charge often increases as much as 100 percent. A few municipalities dispense with formulas and charge a fee that is equal to the cost of the connection. In these municipalities and some others, when the formulas are designed to cover costs, the fee is reduced if some of the labor and material is supplied by the customer.

The permit and inspection fees are generally small and are intended to cover the costs of the inspection and issuing of the permit. Nearly all of these charges are less than $10.

CHARGES TO OUTSIDE CUSTOMERS

There is a large variation among municipalities in the service provided and the charges made to families and firms residing outside the corporate limits. According to the 1953 survey conducted by the American Public Works Association,(22) 65 percent of the cities with over 25,000 population did not provide service outside the corporate limits. Of the local units that provided service outside the municipal boundaries, over 60 percent charged higher rates to outside customers.

Since 1953, there has been an increase in the proportion of local government units that provide sewage service to families and firms residing outside the municipalities. In some cases, this is because a sanitation or utility district has taken over the sewer function from cities and has expanded the area of service. In other cases, cities themselves have expanded the service area to include customers outside the corporate limits.

The state reports indicate that over 50 percent of the municipalities above 5,000 population provide service to outside customers.(23-43) A majority of these levy a higher service charge against the outside customers. In some municipalities the service is provided free to inside customers but a charge is made to outside customers. In others, where a charge is made to both sets of customers, the basis of the charge is different for each type of customer. Although this procedure makes it difficult to compare charges, it appears that the charge is generally higher for outside customers.

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The most common method for charging a higher rate for outside customers is simply to set some multiple of the rate for inside customers. The multiple used varies among municipalities. The most frequently found practice is to charge a rate to outside customers that is between 150 and 200 percent of the inside rate. In some municipalaties, however, the outside rate is over three times the inside rate.

Municipalities also tend to charge higher connection and tap fees to outside customers. The difference in connection charges levied against the two different types of customers varies even more among municipalities than the difference in service charges. In some cases, the inside and outside charges are the same. In other cases, the inside fee is a token charge while the outside charge is substantial. On the average, the outside connection fees are approximately 80 percent higher than the inside fees.

The levying of higher user charges against outside customers can be justified on several grounds. Most of these arguments are based on the assumption that charges should be related to sewer costs. One reason for charging a higher rate to outside customers is that the businesses and residences located outside the municipality are placed on larger parcels of land. The larger lots mean that both the construction and the operation and maintenance costs may be higher for each outside customer. A second reason for the differential in charges is that outside customers may be located farther from the interceptor sewer and treatment plant. This again causes the costs involved in servicing users located outside the municipality to be higher. A third reason is that the sewer rates levied against inside users may not be high enough to cover the operation and maintenance cost. The municipality can obtain additional revenue from inside customers through special assessments and the property tax. This alternative is not open in the case of outside users, however, so the municipality must levy higher user charges against them. Another reason is that the construction costs may be partially financed through property tax and special assessment proceeds, and higher user charges are a method of obtaining a share of the capital costs from outside customers. Finally, the sewer system inside the municipality may have been built at a time when construction costs were lower than when the outside portions of the system were added. In addition, some of the inside system may be fully amortized. In this situation, the outside sewer rates should be higher than the inside rates.

SEWER ADDITIONS

Although many local governments distinguish between inside and outside customers in their rate schedules, a large number do not distinguish between old and new customers when additions are made inside the municipality or sanitation district. The increased costs of additions are generally spread among all customers. This procedure is administratively simple but it can be criticized on equity grounds. The construction costs associated with the addition are likely to be higher than the construction costs of the orginal system. The construction costs of the old system may also be fully amortized. Additions may cause other costs to increase because of greater strain on the entire system. If the costs resulting from additions are spread among all the users, the old customers are subsidizing the new customers unless the operation and maintenance costs of the old system are much higher than for the new. The subsidizing of the new customer by the old customer also tends to affect the income distribution. The sewer additions will serve primarily the relatively high income families who live in suburbs, whereas the old system serves, for the most part, the low income individuals who reside in the core of the city. Consequently, income differences will be increased if old customers pay part of the cost of servicing new customers.

JOINT TREATMENT AND INDUSTRIAL SURCHARGES

A growth in joint treatment (municipal and industrial wastes treated in the same system) has been observed in recent years and is described in Volume I of this report.

Primary reasons for the growth in joint treatment are the increase in number of sanitary districts and the increase in the number of industries willing or permitted to join the waste treatment systems owned by the cities and towns.(18) The growth in sanitary districts has been important in the joint treatment picture because such districts usually take a much broader view of their responsibilities in pollution control. By the same token, if the responsibility for water quality management shifts to river basin authorities, a further increase in joint treatment is likely.(57)

Although a description of the various approaches of municipalities toward industrial wastes is imprecise because of lack of data, some generalizations can be made about such approaches. In constructing waste ordinances, more and more municipalities are following the format suggested in "Guide Lines for Drafting a Municipal Ordinance on Industrial-Waste Regulations and Surcharges", a 1959 report of the American Public Works Association.(7) Most municipalities have at least a general provision in their waste ordinances stipulating that harmful and objectionable materials may not be discharged into the sewer system. In some cases there are several items which are specifically prohibited. Commonly prohibited wastes include; certain dairy, meat packing, and poultry wastes; specific concentrations of oil, grease, paint, and acids; inflammable items; ashes; liquids above a certain temperature; and some radioactive materials. A few municipalities will not allow, or allow only with special permission, the discharge of wastes that have abnormal concentrations of suspended solids or BOD. However, the allowable concentrations vary significantly among municipalities.

For the 24 cities listed in the 1955 American Public Works Report on Industrial Waste Disposal,(21) the range of allowable concentration of BOD and suspended solids is from 250 to 1200 (parts per million) and 200 to 1500 (parts per million) respectively. For the 15 cities that indicated specific limits on oil and grease, the allowable concentration is from 100 to 400 (parts per million). If the sewage is above these concentrations, it must be pretreated before being discharged. In the 34 cities that gave data on pretreatment, the percentage of industries within each city that pretreated wastes ranged from less than 1 percent to 100 percent. The median is 20 percent.

To enforce restrictions on waste discharges, periodic tests are conducted. For the 21 cities reporting on this topic, the frequency of tests ranged from less than one month to 36 months.(21) Seventeen of the cities conducted tests at six-month intervals or less. The methods of testing also vary.

Although some cities have very detailed restrictions and vigorous enforcements, the majority of the municipalities accept industrial wastes with no examination or pretreatment. There are, almost certainly, some municipalities that are incurring large costs by accepting certain types of industrial wastes. These costs are then passed on to the local taxpayers or other users. The full extent of this problem is not known.

Another approach that municipalities have taken toward industrial wastes is to levy special charges on specific types of waste. Although surcharges might be thought of an an alternative to restrictions, in practice many of the municipalities with detailed lists of restrictions also employ surcharges. There are several industrial charge formulas that are in existence or that have been advocated by experts. These formulas are normally grouped into four categories.(11)

The constant rate formula is the most commonly used type of formula and includes some of the charge methods that have been previously described. It involves charging on the basis of a unit such as; water use, number of fixtures, number of employees, or time period. Most sophisticated versions of the formula include varying the rate by the type of business. One example of this latter variation is a charge which is based on the percentage of the water bill, where the percentage varies by the type of business.

Constant rate formulas are simple to administer and they take into account the differences in the strength of sewage. They do, however, have some disadvantages. The rate schedules are generally constructed on the basis of some crude operating rules, negotiation with the business in question or, at best, industrial averages. Since testing the effluent of the firms is not usually involved in setting the rates, the charge is not directly related to the effluent. Consequently, it is not likely to induce a business to improve the quality of its effluent. Charges that vary by the type of business are, however, an improvement over charges that are identical for all businesses. For small municipalities where the gain in accuracy from testing is small in comparison to the expense involved, this type of charge may be the best choice.

A Q-Q (Quantity-Quality) formula is usually what is meant when the term surcharge is used. Approximately 100 to 200 municipalities use a formula of this type and the number is increasing.(19-43) Surcharges based on this formula take into account both the volume and the characteristics of the sewage. Generally, the concentrations of suspended solids and BOD are included in the formula. Some formulas also include chlorine demand and other factors. In most municipalities it is only the concentrations that are above the "normal" levels which are subject to the charge.

The definition of normal concentrations varies among municipalities. For the 15 cities presented in the American Public Works Association Report,(21) the concentrations above which a charge is levied range from 200 to 1,000 ppm of BOD and 150 to 1,000 ppm of suspended solids. The median is 250 for BOD and 300 for suspended solids. Thus, although the range is large, most of the municipalities tend to use the average concentration of BOD and suspended solids found in domestic sewage as the "normal" level.

A typical Q-Q formula (14) would have the following form: $C=V(Y_1 + Y_2(B-B_n)+Y_3(S-Sn))$ where C is the charge, V is the volume, Y_1, Y_2, Y_3, are the surcharge rates, B and S are the actual concentrations of BOD and suspended solids, B_n and S_n are the normal concentrations of BOD and suspended solids. Instead of computing the charge for each, some municipalities have volume charges that vary by ranges of BOD and suspended solids concentrations. The rates chosen usually reflect an estimate of the cost involved in the collection and treatment process. Since the levels of BOD and suspended solids do not greatly affect the collection system, the rates for these factors are determined primarily by treatment costs.

There are several advantages of employing the Q-Q formula. It is an equitable charge in that the characteristics of the business effluent and the costs associated with those characteristics are directly taken into account. Another advantage of this type of formula is that it provides an inducement for businesses to reduce the strength and the volume of their effluent. The reduction in BOD and/or suspended solids that followed the introduction of surcharges in Cincinnati, Ohio; Otsego, Michigan; Winnepeg, Manitoba, Canada; some Oregon cities, and other municipalities, is described in the literature.(9-13) The officials in these cities have been very satisfied with the industrial reponse to the surcharge. In Otsego, the volume of BOD fell from 28,000 to 22,000 to 15,000 pounds per day in the three billing periods that followed an introduction of a surcharge.(9) In Cincinnati, there was a large reduction in surcharge revenue, which was based on the amount of BOD and suspended solids in the effluent, in the first few years that the surcharge was in existance.(13) This would, of course, indicate that the waste loadings were substantially reduced as the effects of the surcharge were felt and industry could make changes to minimize these effects.

Although the incentive for reducing the amount of BOD and suspended solids continues as long as the surcharge is in effect, it appears that most of the reduction is obtained in the first few years after the surcharge is introduced. A surcharge causes industrial firms to immediately improve their housekeeping procedures and possibly to introduce some waste pretreatment. The charge also may induce firms to adopt new processes which produce less waste or that recover the wastes. After this initial period, however, it appears that the chief effect is to restrain businesses from introducing practices that would greatly increase the amount of BOD and suspended solids. In Cincinnati, which introduced a surcharge in 1953, the amount of the charge has increased for some businesses and decreased for others over the last decade. The annual amount of revenue obtained from surcharges has been usually between $400,000 and $600,000 during this period.(12),(15)

The chief disadvantage of the Q-Q formula is that the administration of the charge is complex. When the surcharge is introduced, either the wastes of all firms must be tested, or an initial charge is made on the basis of other information and the accuracy of the charge verified by later tests. In addition, periodic tests must be performed to make certain that the charge base continues to be accurate.

The effluent sampling and testing practices vary by municipality. In some cases, samples of the effluent are taken at wide intervals of time. In other cases, samples are taken several times an hour on a twenty-four hour basis for a week or more. The samples are then analyzed or composited and analyzed to determine the effluent quality. The cost of the sampling and testing procedure for a single firm may exceed $500. The total administrative cost can be reduced by sampling only a few firms in each industry, and basing the charges for all firms in the industry on these samples.(8) However, this method tends to diminish the incentive for an individual firm to reduce the concentrations of BOD and suspended solids in its effluent since such a reduction would not lower the effluent charges. Inequities among firms would also rise if charges are not related to costs.

Another difficulty in developing a Q-Q formula is in determining the rates to be applied to each factor in the formula. Rate development requires considerable engineering analysis of the relationship between effluent characteristics and treatment costs. In addition, a decision has to be made on the levels of concentration that will be defined as "normal". On balance, the Q-Q formula has much to recommend it. It matches charges for the effluent with the cost of handling it for each firm and it provides an inducement for firms to reduce the quantities of undersirable substances discharged into the sewer system. However, the complexities in sampling and other administrative factors severely limit the number of municipalities that can utilize this surcharge formula. The complexities also limit the number of businesses that a municipality will find it worthwhile to sample and subject to the surcharge.

The California formula, as it is applied, has two interpretations. One interpretation is that a municipality should examine various flat rate and Q-Q charges and select the one that is most appropriate. Another interpretation is that the amount or proportion of municipal taxes paid by the business should enter the formula.

The Joint Committee formula (52) requires that all sewer costs be divided into user and nonuser categories. A firm's responsibility for sewer costs would be its share of the nonuser costs, payable through the property tax or special assessments, plus its share of user costs, payable through Q-Q type of charge. This formula will be described at greater length in the next section since it deals with several broad issues.

REVENUE FROM USER CHARGES

The revenue from user charges is only a small proportion of total municipal revenue. However, the amount of such revenue is substantial for some municipalities. For the 43 largest cities, the revenue from all sewerage sources totalled $109 million in 1965-66.(16) This was equal to less than two percent of total municipal revenue for the 43 largest cities; however, New York obtained more than $16 million and Detroit more than $7 million from this source. In per capita terms, Cincinnati and Seattle were the leaders with over $10 per person per year.

In most cities revenue from sewerage service charges comprises approximately 90% of total user charge revenue. (23-43) The remainder of the revenue is obtained from connection fees, inspection fees, sale of sludge effluent, and investment income.

The yield, on a per capita basis, from service charge varies greatly among municipalities but a few generalizations can be made. The yield does not appear to depend on the type of formula employed. Municipalities that charge a uniform rate to each customer generally obtain less than the average but the yields from charges based on water use, fixtures, and type of customer are very similar.

Excluding the municipalities that levy a uniform rate, the average per capita yield for all municipalities is approximately $7 per year as estimated from available information.(19-43) This shows an increase from the 1953 Public Works Study(21) which indicated a per capita yield of approximately

$3 per year and the 1962 Municipal Finance Officers Study(19) which reported a figure of $4.37. One reason why this current estimate is higher than those given in previous studies is that municipalities have increased sewer service rates to take account of increased costs which have increased both because of inflation and because of the increase in waste treatment. A second reason is that this $7 estimate excluded uniform flat charges whereas the other estimates included all sewer service charges. A third reason is that the proportion of the population that is serviced is increasing and per capita figures are generally based on the entire population, rather than the serviced population. A fourth reason is that it is likely that businesses are paying an increasing share of the sewerage revenues. The per capita yield is generally below average for cities over one million population and for municipalities under 10,000 population.

The variance in the yield increases as smaller municipalities are examined. In municipalities under 10,000 population, many obtain more than $20 per person while many others receive less than $2. A very few small municipalities obtain more than $40 per person.

In most municipalities, the revenue from user charges is greater than the operation and maintenance costs of the entire sewerage system, but is less than the sum of operation, maintenance, and debt service costs or the sum of operation maintenance and capital expenditures. For the bulk of municipalities there are no data available that indicate whether the revenue from user charges is greater than the operation, maintenance, and debt service costs associated with treatment facilities only.

For municipalities over 50,000 population, operation and maintenance expenditures averaged $3.29 per person in 1965-66.(16) Total sewerage expenditures averaged $9.45 in the same period.(16) The per capita revenue from user charges usually fell somewhere between these values for most municipalities.

In Texas, where current statistics are available, revenue from sewer service charges in approximately 90 percent of the municipalities is greater than the operation and maintenance costs of their sewer systems.(40) In some municipalities, the sewer service charge revenue is more than twice the operation and maintenance costs. There is some evidence that a few municipalities derive revenue from user charges that surpasses the debt service and the operation and maintenance costs.

The 1962 study of City Finance Officers Association indicates that two-thirds of the cities reporting on the question stated that sewer services are completely self-supporting.(19) This is a much higher percentage than is suggested in the information given in the previous paragraphs. There are however, some possible explanations for this difference. Many municipalities intend only to meet operation and maintenance costs from user charges. This is evidenced by the fact that in some of the State studies, municipalities that do not cover debt service and operation and maintenance costs from sewer service charges still indicate that the yield from these charges is satisfactory. Another possible explanation may be that the respondents to the 1962 survey excluded storm sewer costs in their calculations thereby lowering the cost with which user revenue was being compared.

This examination of user charge revenue and costs shows that most municipalities are currently obtaining enough revenue from user charges to completely cover the operation and maintenance costs of the entire sewerage system and to make some contribution toward debt service costs. The relation between revenue and cost varies among municipalities, but there is some pattern to the relationship among population size categories. The ratio of revenue to costs is lowest for the municipalities over 500,000 and under 5,000 population.

DIVISION OF COST RESPONSIBILITY BETWEEN USERS AND NONUSERS

The division of the burden involved in providing funds to pay for a Government supplied good or service depends on many factors. Important factors include the nature of the good or service; and the interpretation and relative weight placed on commonly accepted tax canons such as equity, economic efficiency, administrative simplicity, and revenue adequacy. In this chapter, the division of cost responsibility between users and nonusers and among nonusers is examined. The following chapter takes up the question of dividing the user share of the cost burden among categories of users.

NATURE OF THE SEWAGE SERVICE

Governments provide many goods and services that could be classified in several ways. They could be classified by function, type and location of beneficiary, Government department, or similarity to goods and services produced and marketed in the private sector of the economy. It is the last classification system, similarity to privately marketed goods and services that is of relevance here. At one extreme, Government provides goods and services like national defense and justice. These goods and services, which are often called public goods or pure public goods in the economic literature,(44-55) possess qualities that prevent them from being marketed through the price system because the benefits are widespread and indivisible. Thus, it is difficult to determine the amount each individual or family is willing to pay for the good or service. Even if the amount could be determined, there is no way of excluding an individual or family from enjoying the benefits from the good or service if he refuses to pay for it. For such goods and services any relationship between costs and benefits on the individual level is very tenuous; the costs are usually covered from general tax levies.

At the other extreme, some goods and services supplied by Government are similar or even identical with commodities sold by businesses. Examples of these commodities include electricity and the postal service. Electricity is supplied by both private firms and Government. Likewise, packages are delivered by private firms and some have even advocated turning the postal service over to a private corporation. These services can be easily marketed using the price mechanism because they can be sold on an individual basis and the benefits accrue almost solely to the purchaser. When these services are provided by the Government they can be marketed in such a way that they are self-supporting.

In an intermediate position are goods like education. Education is divisible and thus, can be sold on an individual basis, but it yields general social benefits over and above the financial benefits obtained by the initial recipient. If these good or services, called quasi-public or merit wants in the economic literature,(45),(54) were marketed through the price system, consumers would only take into account the direct financial benefits they receive. Consquently, an insufficient quantity of such goods and services would be produced. In these situations Government often increases the production and consumption of the commodities either by supplying them directly or by subsidizing consumers and producers of them. Thus, the cost of supplying these commodities is met partly through the charges or taxes on the users or consumers and partly through general tax levies.

The position of the service provided by the sewage collection and treatment system is not clear. On one extreme it could be argued that the sewage service is similar to electricity or the postal service in that the service can be marketed using the price mechanism. It could also be argued that the benefits accrue almost exclusively to those that discharge wastes into the system because they would have to find an alternative way of discharging wastes in the absence of the system. On the other extreme, it could be argued the sewerage service is nearly a pure public good. Sanitary waste, at least, is a normal consequence of living. The disposal of it should be a public responsibility because the benefits resulting from disease control and the preservation of recreational facilities are widespread. In a more moderate position is the argument that the sewerage service is similar to a merit want. Those that discharge wastes into the system would likely purchase some of the sewage service, particularly the collection system, becuase it is an efficient method of disposing of wastes. However, if the sewerage service is marketed using the price mechanism, it is likely that waste dischargers would purchase virtually no sewage treatment and not as much collection service as compared to the amounts thought to be socially desirable in terms of disease control and preserving recreational facilities. The nature of the sewerage service is further complicated because the sewerage system may yield a joint product in that storm and infiltration water, and sanitary and industrial wastes are often collected and treated in the same system.

Given the lack of agreement about the nature of the sewerage service there are several views that have been expounded or could be advocated in regard to the division of sewerage costs among groups in the economy. One division commonly made is between users and nonusers. Users generally include households and businesses that discharge effluent into the sewerage system. Nonusers include groups that may have some obligation to pay for the sewerage system because it aids in draining property. The availability of sewerage service may increase property values. The sewerage system may also provide services that yield general benefits such as disease control. These services may provide benefits that vary in scope from a community to the entire country.

The division of costs into user and nonuser categories may appear, at first examination, to be irrelevant since many individuals and businesses are both users and nonusers. They discharge wastes into a sewer system, own property and pay Federal, State, and municipal taxes. However, individuals and businesses do differ in the amount and value of property owned, the amount of State, municipal and Federal taxes paid, and the volume and type of waste discharged. Thus, not only does the form of payment for the sewerage system depend on the division of cost responsiblity among users and nonusers, but the amount paid by an individual or business depends on this division.

ALLOCATION THEORIES

There are many points of view that could be put forward regarding the division of sewerage costs between users and nonusers. Many of these points of view have been previously advocated in regard to other Government supplied goods and services.(46),(53) In some cases, the point of view has been put forward as a single argument rather than as a comprehensive theory with the assumptions and consequences explicitly stated. However, an attempt has been made to construct several theories from commonly held points of view in order to illustrate the different solutions that could be obtained, and to determine whether there is any consensus regarding the division of cost responsibility between users and nonusers.

The following theories regarding the division of sewerage costs stress equity, but economic efficiency and administrative simplicity are also considered. Equity considerations are more complicated for sewage service than most other Government supplied goods because there are differences of opinion regarding the responsibility that an individual (business) should assume for the waste he (it) creates. There are also differences regarding the interpretation of benefits received.

Public Utility Theory

One view is that sewage service is similar to electric or postal service and that the sewerage system should be operated according to the commerical principle. User charges should be set at a level where the revenue obtained from them will cover the entire cost of collecting and treating sewage. This theory would encourage the use of revenue bonds so that the user charges and sewage costs would be directly linked. The only justification for a government body supplying the service is that the Government is likely to be more efficient than a private corporation or that there is some likelihood that a private firm would act as a monopoly. This theory places the responsiblity for sewage with the creators of it. It also assumes that the costs associated with the collection and treatment of storm water and infiltration water should be paid by users. This public utility concept has been suggested for many services provided by government. The argument for applying this concept to the sewerage system is especially strong because sewage and water services are often operated by the same municipal unit. Water service has been operated on the commercial principle in many municipalities and it is argued that this principle should be simply extended to sewage service.

Diffused Benefits Theory

Supporters of this view conclude that the benefits of sewage service are diffused throughout the economy. They believe that the collection and treatment of storm water benefits every individual and business in the municipality. They also believe that the benefits from collection and treatment of sanitary sewage and industrial wastes extend to individuals far outside of the municipality as well as those inside. This is because individuals in one area are benefited if another area employs disease control practices and prevents recreational areas from becoming polluted. Since the benefits are so diffused the sewerage costs would be met by the Federal, State and municipal Governments through general tax levies.

This theory assumes a "right to pollute" and does not place any of the responsibility for sewage collection and treatment on those that create it; consequently, it does not support the employment of user charge levies. This theory may have some merit but it certainly is an oversimplification. Although it may be difficult to identify the beneficiaries of the system with a great deal of precision, some individuals and businesses benefit more than others.

Historical Theory

This theory states that the division of cost responsibility should be the same in the future as it has been in the past. The theory does not have any explicit supporters and it has a weak theoretical basis. Nonetheless, even when the orginal cost division has had no logical basis but simply grew like Topsey, there is often a tendency to perpetuate it. This is partly because customers especially businesses, have made decisions, such as the location of a plant, on the basis of existing conditions. Changes may be viewed as altering the rules in the middle of the game, thus, this theory may provide the best political solution.

Added Expenditure Theory

This theory has two variations. One variation is that sewers exist primarily to handle storm sewage; the second variation is that collection and treatment of sanitary and business wastes is the prime function of the sewage system. This theory has the most relevance, of course, where there is a combined system. In this situation, which is relatively common in the United States,(50) the user share of the costs is likely to be greater if the second variation of the theory is implemented.

Under the idea that sewers exist primarily to handle storm sewage it is argued that the cost that would occur if the system handled only storm water should be allocated to nonusers; primarily property owners. Users would then be liable only for the additional costs resulting from collection and treatment of industrial, commercial and sanitary wastes. Because these additional costs are related to use, they would be financed by user charges. One basis for this variation of the theory is that storm sewers existed before sanitary sewers.

The second variation would argue that costs of the sewerage system, **if it** carried only sanitary and business wastes, should be allocated to users and financed by user charges. The additional cost resulting from a combined system would then be allocated to nonusers. The rationale for this variation of the theory is that the collection and treatment of sanitary and business wastes are more important because of disease and pollution control than is the collection of storm water.

Alternative Revenue Theory

This theory yields the same conclusion as the public utility theory; this is, users should pay the entire cost of the system. The reasoning behind this theory is that municipalities are faced with large expenditure demands for items that yield benefits which are usually more diffused than benefits from sewage services. Since these programs must be financed through the property tax, it is better to finance sewage services through user charges because they generally encounter less resistance than do increases in the property tax. Consequently, user charges should be high enough to completely finance the sewerage system. The theoretical underpinnings for this formula are weak but it may be a good approach in terms of public acceptability.

Capital and Operating Cost Theory

This theory assigns the responsiblity for the capital costs of the system to nonusers, primarily property owners, and the responsibility of the operating and maintenance costs to users (those who discharge wastes into the system). The reasoning behind this theory is that the sewers are generally connected to each unit of property and, consequently, the right to use the sewer is related to property. The amount discharged into the sewer relates to the degree of use and the cost of this should be borne by the user. This formula is simple but is very crude and arbitrary.

Differential Benefits Theory

Under this theory the cost is divided in proportion to the benefits obtained from the sewerage service. Property owners benefit from the collection of storm and infiltration water through prevention of damage from floods and leakage and improved appearance of the property. Businesses and individuals, who create the sewage, gain the most from the collection of sanitary and commercial sewage because they would have to find other means of disposing of it. All individuals, in and out of the city, obtain some benefits from the collection and treatment of sewage in terms of disease control and the maintenance of unpolluted streams and lakes for recreation and other uses. In a broad sense, the further an individual lives from the municipality in question, the less he benefits from the sewage system. User charges would only be related to the benefits measured by the cost of alternative methods of waste disposal. Nonusers would pay in relation to the benefits obtained by property owners and the general public in the form of drainage, disease control, and greater recreational and other use benefits.

This theory has a sound base but it does not place any direct responsibility for pollution control on the creators of the wastes and it is difficult to implement. It involves computing the hypothetical cost, if there were no sewerage system, of: (1) storm and subsurface water, (2) waste disposal, and (3) disease. In addition, the reduction in recreational benefits and other water uses would have to be computed.

Relative Use Theory

This theory requires that the sewerage system be divided into parts such as the collection system and the treatment plant. The cost for each part is then divided in proportion to the relative volumes of sewage flowing through that part of the system. Nonusers, primarily property owners, pay for the portion allocated to storm and infiltration water while users pay for the share allocated to sanitary and commercial sewage. This formula appears simple but it would be difficult to implement. The volume of the two types of sewage flowing through different parts of the sewer is difficult to determine at any given time. It is even more difficult to determine the average flows over a period of time.

Joint Committee Theory

This sophisticated theory was formulated by a joint committee of representatives from eight national organizations: American Society of Civil Engineers, American Bar Association, American Water Works Association, National Association of Railroad and Utilities Commissioners, Municipal Finance Officers Association, Federation of Sewage Works Associations, American Public Works Association, and Investment Bankers Association of America.(47)

The formula divides the costs between property and users. It involves dividing the annual costs into fixed and operating categories. The fixed costs are further divided into the collection, interceptor, pumping station, and treatment plant categories. The components of these subcategories are itemized in detail. These costs are then allocated to user, storm water, future growth, and infiltration categories on the basis of the volume and characteristics of each type of sewage. Property is assigned the responsiblity for the future growth, infiltration, and storm water totals. Roughly the same procedure is followed for operating costs. They are divided into the collection, interceptor, pumping station, and treatment plant categories and allocated to users and property on the basis of volume and waste characteristics. The operating and fixed costs are then totalled for the use and property categories. The property share is to be obtained from special assessments and the property tax and the user share by user charges.

This formula has much to commend it. It attempts to relate costs and benefits in a detailed and logical fashion. The cost allocation is determined by analyzing the impact of the different types of sewage on the various components of the sewerage system. In this process both the volume and the strength of the different types of sewage are considered. (48-49) More recent studies have expanded this analysis. One difficulty with the formula is that it is complex to implement.

This formula has a good deal of merit but there are two aspects of it that are worthy of more consideration. One is the assignment of the future growth costs to property. If the growth is expected to result from an expansion in areas where sewers are already installed, but not used, the procudure is correct. If, however, the increased growth is to result through an increase in the sewage discharged, due to an increase in water consumption, the costs should be allocated to users. If the expansion is expected to result from further development of land, the cost should be shared between users and nonusers.

The second aspect of the formula that might be examined is the allocation of the costs associated with sanitary and commercial sewage to the users. The case is strong for allocating the collection costs to the users because, in collecting the sewage, the municipality is performing a function that would otherwise have to be performed by the users themselves. Wastes have to be disposed of some way and the municipality can likely do it at least as well and at as low a cost as the user.

This is not the case with treatment, however. Users would not generally treat sewage as a normal course of events. The case for charging users for treatment rests on the argument that water is owned by the public and the quality of it should not be reduced by individuals and firms who use it. If this argument is accepted, it is clear that the cost of treating commercial waste should be charged to users. Otherwise, the **financial** costs to the business that discharges waste into the system would be lower than the social costs. This would not conform to accepted definitions of equity and efficiency. Under this argument, individuals should also pay for the cost of treating domestic sewage. If they do not pay for this treatment, they would be shifting costs associated with the sewage to future generations if water quality is reduced or to other individuals if treatment is performed.

These theories yield varied results. The users share varies from 100 percent under the public utility and alternative revenue theories to zero in the diffused benefit theory. The share allocated to the three levels of government varies from zero in many cases to 100 percent under the diffused benefit theory. There is also a great deal of variance in the share allocated to property owners.

Conclusions are difficult to make in light of such varied results. However, many of the formulas assign some cost to users and some to nonusers and any consensus or compromise formula would allocate some of the costs to each group. In addition to the factors considered in the discussion of the theories, strong support can be marshalled on other grounds for allocating some of the sewerage costs to users and some to nonusers.

There are several reasons why users should meet a substantial share of the costs of sewerage systems. Users benefit from the collection and treatment of their wastes and it is equitable that they pay for this service. If municipalities did not operate a sewage system, users would have to find other means of disposing of their wastes. It may be that an alternative way of disposing of wastes would be more expensive for users than if they met the full costs of the municipal system. Users charges can also be defended on grounds of economic efficiency. If businesses were not subjected to user charges, the financial costs of production for businesses discharging large amounts of waste would be lower than the social costs of production. This would result in profits of these businesses being too high and/or the prices of the products produced by these businesses being too low. This, in turn, would likely distort production and consumption patterns away from an optimal position.[2] A properly designed user charge system conforms more to equity and economic efficiency criteria than other ways of raising revenue. This is because a properly designed user charge relates the cost of providing the service to the amount or level of service for each customer.

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[2] This point is covered in more detail in the next chapter.

Effectively administered user charges also can improve the management of industrial wastes. When industrial businesses are first faced with charges based on the volume or strength of the effluent they generally change housekeeping procedures to reduce the amount of waste discharged. Over a longer period, they further reduce the amount of waste discharged into the municipal system by changing production processes or by pretreating the waste. Some examples of this are presented in the previous section of this volume under the heading "Joint Treatment and Industrial Surcharge".

User charges also provide a relatively stable source of funds for sewerage authorities. This facilitates planning and allows for an orderly expansion and upgrading of the sewerage system. In the absence of user charges, the funds available for the sewerage system may be subject to fluctuations from year to year because of the dependency on annual appropriations. This disrupts planning and may result in many short-run solutions that are cheap at the time but costly in the long-run.

There are also several reasons for assigning some of the costs of the sewerage system to nonusers. Property owners gain from sewerage systems because of the collection of storm and infiltration water where combined systems exist and because property values are positively affected by the availability of a sewerage system.

The general public also benefits from improved water use, disease control, recreational opportunities and esthetics. If users were left to their own devices in waste disposal, it may be that disease control and recreational opportunities would be at a lower level and odors and unsightly views at a higher level.

A case can be put forward for allocating some of the costs to users and some to nonusers but no exact division of costs between users and nonusers can be specified. Each situation must be examined in terms of the relevant characteristics. For example, property owners should bear a smaller proportion of the costs in areas where storm and infiltration water is unimportant as compared to areas where this water volume is important. Policy considerations related to ability to pay and desired rate of investment for controlling pollution also influence the shares borne by higher levels of government. For example, it may be the Federal and State government policy to redistribute income by giving greater grants to poor rather than wealthy municipalities for the construction of sewerage systems. It may also be that the Federal and State governments will give larger grants at one period of time, as opposed to another, in order to quickly meet some goal such as a standard of water quality.

The exact division of costs between users and nonusers cannot be specified, but it can be argued that users should bear a larger proportion of operation and maintenance costs than of capital costs. This is because many of the operation and maintenance costs are related to volume and other characteristics of the waste discharged into the system.

Once the division of the cost responsibility between users and nonusers is determined, the question of how the revenue will be collected still remains. Again there is no universal method of collecting the revenue that can be specified. There are several types of user charge that could be employed to meet the user share of the costs. Similarly, on the nonuser side, there is also a choice of revenue sources. Property owners may meet their responsibility through a number of means. Often, the property share is met though special assessments or through the price of property in cases where developers install the sewer system. The property share can also be met through the property tax.

ROLE OF FEDERAL AND STATE GRANTS

Some of the formulas described in the previous pages do not assign any role in the financing of sewer systems to State and Federal Governments. Others assign a small role at most. The nonuser share is generally regarded as the responsibility of the property owners. However, there are several reasons why Federal and State grants should be used in this area. These grants will enable the necessary standard of water quality to be obtained more quickly and will encourage municipalities to plan and constuct sewage systems instead of devoting effort to other projects. The grants aid the municipalities over the difficult transition period when sewage treatment plants are being constructed, the system is under utilized, user charges have not or cannot be depended upon to cover costs, large increases in the property tax are politically unacceptable and debt limits are nearly reached. The use of the Federal and State grants are likely to place more of the burden on meeting sewer costs on high income receivers than if the costs were completely met by user charges because the Federal and State taxes are more income equalizing, on the average, than user charges. On balance, Federal grants coupled with regulatory actions have tended to stimulate and make financially possible, investments in waste treatment facilities.

THE DISTRIBUTION OF COST RESPONSIBILITY AMONG CATEGORIES OF USERS

In previous section the problem of allocating sewerage costs between users and nonusers was discussed. Once it is determined how much revenue must be obtained from user charges in order to cover the sewerage costs allocated to users, the question of designing a suitable system of charges to collect this revenue must be considered. A user charge, like any Government levy, should be designed to meet the tests of equity, economic efficiency, administrative simplicity and revenue adequacy.

GENERAL CRITERIA

Equity

Equity is often defined in terms of one of two principles of taxation: ability to pay and benefits received. The ability to pay principle suggests that a levy should be related to the capacity or ability of an individual to pay the tax or charge. In practice, capacity or ability to pay a levy is often defined in terms of income. This principle, although important in analyzing the effect of many individual levies and the total tax system, is not usually given very much consideration in the examination of user charges.

User charges are generally justified by employing the benefits received principle. This principle suggests that charges or taxes should be related to the benefits that the economic unit receives from Government. In the case of sewage collection and treatment, the implementation of this principle means that individuals and firms should be charged in relation to the benefits received from the sewerage system.

The benefits of sewage collection and treatment, like the benefits of many other goods and services provided by the Government, are difficult to quantify.

It is usually difficult for an individual to quantify the benefits received from a service. The problem is further complicated because the benefits received are likely to be different for each individual receiving the same service. Even if individuals could quantify the benefits received, it is impossible to make comparisons among individuals in benefit terms. If one person states that sewage service is worth 60 benefit units and another states that it is worth 40 benefit units, no conclusions can be drawn because the scales of measurement may be different.

It is also difficult to measure the benefits received in money terms. There is no easy way of observing the amount that individuals are willing to pay for the service. If asked, each individual will likely give a low figure in order to reduce his charge, and the validity of the answers cannot be checked. Another method of determining benefits is to estimate the cost of the best alternative method of sewage disposal. As pointed out in the last chapter, however, it is extremely difficult to judge what method would be selected as a reasonable alternative to a sewerage system.

Because of the difficulties in estimating benefits, the benefits received principle has often been interpreted as a cost occasioned method. Under this method, those using the service are charged an amount equal to the cost of providing them with the service. Thus, if it is judged that equity can best be served by implementing the benefits received principle, each individual (business) should be charged an amount equal to the expenditure that the Government makes in providing sewage service to him (it).

Economic Efficiency

Taxes and charges levied by governments are often used as tools to accomplish certain economic goals. Although they may be introduced to pursue specific objectives, they should also be designed to interfere as little as possible with the generally accepted economic goals of society. Goals commonly mentioned include price stablility, full employment, rapid economic growth, equitable income distribution, viable balance of payments, and economic efficiency.[3]

The type of user charge employed is not likely to have any large impact on any of these goals and any undesirable impact can be easily counteracted by other fiscal weapons except in the case of economic efficiency. The charge method employed by a municipality may affect a business's decision regarding location, production process, and level of output. These decisions, in turn, have implications for the efficiency of the economic system. Usually, economic efficiency can best be served if the price of each good and service is equal to the cost of producing and marketing the last unit of it. This rule or condition holds for many Government supplied goods and services as well as those supplied by the private sector of the economy. Hence, a user charge for sewage with given characteristics should normally be set so that it is equal to the cost of collecting and treating the last unit of it.

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[3] Economic efficiency implies an economic system that maximizes the production of goods and services which best satisfy the preferences of society.

If the charge is set above this level several distortions occur. Businesses that require a large amount of sewer service in their production processes are placed at a disadvantage with other businesses. The costs of the affected firms will rise and their profits fall unless they can increase the price or decrease the production cost of their product. If the prices rise, the distortion is shifted to the consumer market and individuals who make large purchases of these items are penalized. Similarly, individuals who are served by the sewerage system are penalized if the charges are set above the cost of collecting and treating the last unit of sewage. The reverse situation would occur if the charge is below the cost of the last unit.

If the revenues obtained from charges levied on this basis are insufficient to cover the user portion of sewer costs, additional levies that do not affect the charge for the last unit of sewage may be placed on users. Connection fees are independent of charges on the last unit of sewage. Minimum charges also fit this criterion in most cases.

Administrative Simplicity

The user charge should be as simple to administer as possible. For the customer, it should be on a base that is viewed as fair and easily understood. From the point of view of the municipality, a charge should be selected that does not require overly expensive and time-consuming inspections. In addition, the charge should be amenable to a computation procedure that is inexpensive.

Revenue Adequacy

The chief purpose of charges is to obtain sufficient revenue to meet the sewage system costs allocated to users. It is not enough, however, to design a system of charges that will cover current costs. The charge system should be flexible so that it can easily respond to meet changes in cost conditions.

Costs will likely rise in the future through inflation. Costs will also likely rise because improvements in the quality of the service, such as a greater degree of sewage treatment, are likely to occur.

Costs may also be altered through predictable preference and technological trends. For example, it may be that garbage disposals and commercial water cooled air conditioners are becoming more popular, toilets are being designed that use less water; individuals are taking longer showers; and the price of chemicials used in treating certain types of wastes is decreasing. The composition of sewerage customers may change so that there will be fewer single family units and more high-rise apartments. There may also be an increase in the number of industries that will use the municipal system.

A charge system should be designed so that the revenue will expand with increases in costs. It should also be flexible enough to take into account other changes, some of which are indicated above, with a minimum of restructuring.

CONFLICTS AND FORMULAS

It is very difficult to design a charge system that meets all four of these tests (equity, economic efficiency, administrative simplicity, revenue adequacy). A system that scores well in terms of equity is administratively complex. A system that is easy to administer does not promote maximum economic efficiency. These conflicts are clearly indicated in the charge methods described in previous chapters. The following discussion tests the various charge methods against the four criteria just discussed.

Flat Charges

Flat charges per month or quarter that are identical for all sewer customers are the easiest of all the charge methods to administer. The charge is clear and predictable for the customer. For the municipality, the billing procedure is simple. No calculations are required and the bills can be printed in advance of the billing period. The revenue yield is also predictable.

Flat charges are not adequate, however, when evaluated by the other standards. The revenue obtained from these charges tends to be small because those families living in single units will not accept a high charge. They are also unresponsive to change unless the rate is changed. Equity, as defined earlier, is greatly violated by a uniform charge. There is no relation between the charge and the cost of treating the sewage of an individual or business. An individual living alone pays the same amount as a hotel or a service station. The charge does not support the goal of economic efficiency. The charge for additional units of sewage is zero and this is not likely to be the actual cost.

Varying the charge by type of customer improves the formula's rating on the revenue and equity tests without significantly making the system more complex. Although it is more equitable than a uniform charge, it does not take into account the difference in the volume and characteristics of the sewage discharged by businesses in the same category. In addition, the rate schedule is often constructed so that there is only a rough relationship between the charge and the cost of collecting and treating the sewage for each category.

Charging different rates to various categories of customers does little to improve the score on the economic efficiency test. The charge for additional units of sewage remains at zero.

Joint Committee Formula

The Joint Committee Formula described in the last chapter is also used to distribute costs among users.(47) The fixed and operating costs allocated to users are apportioned among volume, suspended solids, and chlorine demand. (More recent studies include BOD as well) (52) Then rates per gallon, per pound of suspended solids, and per pound of chlorine demand are computed. The charge per user is obtained by multiplying these rates by the three measures of his sewage. This formula attempts to equate the charge with the cost of the sewage collection and treatment for each user. Consequently, it conforms to the benefits received criterion of equity. This charge is similar to a volume plus surcharge levy.

The charge is based on the average rather than the incremental cost of collecting and treating sewage so it does not score perfectly on the economic efficiency test. However, it does rank higher than nearly any other charge system. This charge system also is responsive to changes. It is designed to take account of changes in volume and waste characteristics as a matter of course.

The chief weakness of this charge is its complexity. It requires a detailed engineering study to ascertain the relationship between cost and waste characteristics. It also requires frequent and detailed sampling if the charges are to be accurate.

Water Use

A charge based on water use scores between the two previous methods on all four criteria for sewer charge formulas. It does not score perfectly on any test but neither does it score badly on any.

In general, volume is the characteristic of sewage that most influences costs. The collection system is affected very little by most sewage concentrations, and volume is the primary determinant of sewage treatment costs in nearly all municipalities. Therefore, charging on the basis of a water use formula ranks close behind the Joint Committee Formula on the equity and economic efficiency tests. However, these water use formulas charge on the basis of average rather than incremental costs and they are not as accurate measures of cost as the Joint Committee Formula, even when the rates vary by type of business. Another drawback is that they are not as good as the Joint Committee Formula in terms of adaptability to change. This is because they do not make special charges for wastes that cause above average treatment costs.

In terms of administrative simplicity, charges based on water use formulas are not as good as uniform charges but they rank far above the Joint Committee Formula. They do not require a detailed analysis of the sewerage system or wastes. However, they do require that water consumption be metered.

Fixed and Variable

Under this method, the capital part of the costs assigned to users is obtained through tap fees and minimum charges. The operating cost assigned to users is recovered through a charge on volume.

This formula adds the dimension of tap fees to the charges and, consequently, is not directly comparable to the other methods. Although it is not explicit, the other charge formulas assign a relatively low importance to tap fees. Since capital costs are often a large proportion of total cost, tap fees and minimums would likely be higher under this formula.

As compared to using water volume alone, this formula would score higher on economic efficiency and equity grounds, lower in terms of revenue flexibility, and roughly the same on administrative grounds.[4]

Higher tap fees and minimum charges would lower the costs associated with volume, and likely bring the cost based on volume closer to the incremental cost of collecting and treating the last unit of sewage. In terms of equity, the formula attempts to relate costs and charges for each customer. As for revenue, placing more emphasis on fixed charges and less on variable charges makes it less likely that revenue will expand with volume and time.

Fixtures, Water Meters and Sewer Connections

These formulas compare very closely with each other and with flat charges that vary by the type of customer. There are, however, some differences. On the consideration of equity, fixtures measure the concentrations in the sewage better than water meters and sewer connections but they may be less accurate as a measure of volume. These formulas are all nearly identical when examined on economic efficiency grounds. The incremental cost for sewage is zero in all cases. As for revenue, fixtures are much more responsive than water meters or connections. Fixtures tend to increase with increases in income and population. In terms of administration, fixtures require frequent inspections and changes in billings, whereas charges in water meters and sewer connections seldom vary unless there is a change in the level of rates.

DISTRIBUTION OF CHARGES AMONG RESIDENTIAL, COMMERCIAL AND INDUSTRIAL CUSTOMERS

In the preceding pages, various charge formulas were examined in terms of general criteria or tests. In addition to these general tests which apply to many charges and taxes, municipalities may have specific tests or conditions that they wish to impose on a charge system. Municipalities frequently wish to avoid placing a large charge on an individual customer or group of customers. It may be that the municipality is reluctant to place a heavy charge on residential customers but often the reluctance to charge higher prices is directed toward the business sector. For example, a municipality may hesitate to place a high sewerage charge on a particular business or group of businesses, even though justified by the general tests, because of a concern that the business(es) may move or expand its (their) facilities in another location. This situtation is likely to be the most common in municipalities that have one or a few large businesses which employ a large proportion of the population.(57) The problem is further accentuated if the businesses are already faced with decreasing profits or sales and are also large sewer users.

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[4] This is the case if higher tap fees and minimum charges resulted. If these fixed charges are not required, there is no difference between the formula and a formula based on water use.

To provide more information on user charges, a model has been constructed to illustrate how the revenue burden from user charges would be distributed among categories of users under various charge methods. Users are divided into four categories: residential, commercial, industrial, and other. The commercial and industrial categories are further subdivided. The commerical category is first subdivided into retail, wholesale, and service classes. The retail and service classes are subclassified to show the charges on businesses that use larger than average amounts of water in providing their products. The industrial category is subdivided according to the Standard Industrial Classification System. The residential category includes apartments as well as other types of dwellings. The other category includes hospitals, churches, schools, and institutions of a similar nature. In this model it is assumed that these institutions pay user charges but no property taxes.

The charge formulas selected are water volume, flat uniform charge, and one based upon discharge of Biochemical Oxygen Demand. In the case of water volume and BOD, it is assumed that the charges are proportional to these factors. These relatively simple charge methods are selected partly because there are statistics available with which to analyze them. Other charge methods such as the number of fixtures and the Joint Committee Formula are not presented because the required data are not available.

The distribution that would occur if the revenue is obtained by the property tax instead of by user charges is also presented for the purpose of comparison. If user charges are not employed, it is likely that the sewer costs would be financed by property tax proceeds.

The model is based on a large Eastern city, which was chosen for several reasons. One is that it has a diversified industrial and business base. A second and very important reason is that detailed data on water consumption are available from the work of Linaweaver and Howe(59) and from Hittman Associates, Inc.(60) Although many aspects of the model are based on a particular city, it is not a complete and accurate description of any city, since some of the required data are not available in sufficient detail and national averages are used, and because of simplifying assumptions.

The results of the analysis are presented in the two following tables. In Table 1, the percentage distributions for the major user categories are illustrated. Table 2 is more detailed and shows the percentage distributions by user subcategory as well as by major category.

TABLE 1

PERCENTAGE DISTRIBUTION OF USER CHARGE BURDEN BY TYPE OF CUSTOMER AND CHARGE FORMULA

Type of Customer	Uniform Flat rate	Water Sprinkling Included	Volume (Sprinkling Excluded)	B.O.D. load	Prop. Assess
Residential	94.2	59.5	45.7	32.4	69.8
Commercial	5.3	9.2	12.3	15.6	22.2
Industrial	0.4	27.4	36.7	47.2	8.0
Other	0.1	3.9	5.2	4.9	.0
TOTAL	100.0	100.0	99.9	100.1	100.0

Source: Computed using data from: 1963 Census of Business, 1963 Census of Manufactures; Hittman Associates, Inc.; Baltimore Department of Assessment; FWPCA Ohio Basin Region, Cincinnati, Ohio

Totals may not add to 100 due to rounding.

Table 1 shows that the percentage of the burden on residential customers ranges from 94 percent if a uniform flat

TABLE 2

PERCENTAGE DISTRIBUTION OF USER CHARGE BURDEN BY TYPE OF CUSTOMER AND CHARGE FORMULA

TYPE OF CUSTOMER	UNIFORM FLAT RATE	WATER VOLUME SPRINKLING INCLUDED	WATER VOLUME SPRINKLING EXCLUDED	BOD LOAD	PROPERTY ASSESSMENT
Residential	94.2	59.5	45.7	32.4	69.8
Commercial	5.3	9.2	12.3	15.6	22.2
Retail	3.0	4.0	5.4	7.2	15.1
Gasoline Service Stations, Carwashers	0.2	0.6	0.8	1.5	0.7
Restaurants, Night Clubs, etc.	0.7	1.2	1.6	2.9	1.6
Other Retail	2.0	2.3	3.1	2.9	12.8
Wholesale	0.7	1.5	2.0	1.9	2.3
Services	1.7	3.6	4.9	6.4	4.9
Hotels, Motels, etc.	0.0	0.5	0.6	0.6	0.5
Laundries, Barber Shops, etc.	0.9	1.5	2.1	3.8	1.1
Other Services	0.8	1.6	2.2	2.0	3.3
Industries	0.4	27.4	36.7	47.2	8.0
Food and Kindred Products	0.0	7.3	9.8	10.4	1.1
Meat Products	0.0	2.1	2.9	5.9	0.2
Dairies	0.0	1.5	2.0	0.9	0.2
Canned and Frozen Foods	0.0	0.5	0.7	2.0	0.1
Grain Mills	0.0	0.1	0.1	0.2	0.0
Bakery Products	0.0	0.0	0.0	0.0	0.0
Candy	0.0	0.7	0.9	0.2	0.1
Beverages	0.0	0.1	0.1	0.4	0.4
Misc. Foods	0.0	2.3	3.1	0.9	0.2
Tobacco Mfg.	0.0	0.9	1.2	0.0	0.3
Textile Mill Products	0.0	0.1	0.1	0.0	0.0
Apparel Industry	0.1	0.2	0.2	0.0	0.1
Lumber and Wood Products	0.0	0.1	0.2	0.0	0.0
Furniture and Fixtures	0.0	0.3	0.4	0.0	0.1

TABLE 2 (Continued)

PERCENTAGE DISTRIBUTION OF USER CHARGE BURDEN BY TYPE OF CUSTOMER AND CHARGE FORMULA

TYPE OF CUSTOMER	UNIFORM FLAT RATE	WATER VOLUME SPRINKLING INCLUDED	WATER VOLUME SPRINKLING EXCLUDED	BOD LOAD	PROPERTY ASSESSMENT
Paper and Allied Products	0.0	0.8	1.1	1.2	0.4
Printing Industry	0.1	0.1	0.1	0.0	0.5
Chemicals and Allied Products	0.0	7.9	10.6	31.9	1.7
Petroleum and Coal Products	0.0	0.1	0.1	0.3	0.0
Rubber and Plastic Products	0.0	0.7	0.9	0.2	0.2
Leather and Leather Products	0.0	0.0	0.0	0.0	0.0
Stone, Clay and Glass Products	0.0	1.3	1.7	0.3	0.3
Primary Metal Industry	0.0	2.5	3.3	2.0	1.2
Fabricated Metal Products	0.0	2.2	3.0	0.2	0.8
Machinery, Except Electrical	0.0	0.7	1.0	0.1	0.3
Electrical Machinery	0.0	0.5	0.7	0.1	0.2
Transportation Equipment	0.0	1.4	1.9	0.3	0.6
Instruments and Related Equipment	0.0	0.1	0.1	0.0	0.0
Miscellaneous Manufacturing	0.0	0.2	0.2	0.0	0.0
Other	0.1	3.9	5.2	4.9	0.0

Notes: 1. Source: 1963 Census of Business; 1963 Census of Manufactures; Hittman Associates, Inc.; Baltimore Department of Assessment; FWPCA Ohio Basin Region, Cincinnati, Ohio.

2. Values may not add to total due to rounding.

3. 0.0 implies less than 0.05 of one percent.

rate is employed to 32 percent if the charge is based on the amount of BOD discharged. The uniform charge places a large burden on residential customers because there are many more residential than commercial, industrial, and other customers. The median rate of 60 percent is obtained if the charge is based on water volume, with no reduction for sprinkling allowed. There is a marked difference in the burden borne by residential customers if an allowance for sprinkling is allowed -- 60 percent as compared to 46 percent. Part of this difference may result from the assumption that the industrial, commercial, and other customers did no sprinkling.

In the commercial sector, the percentage ranges from 5 percent if a flat rate is employed to 22 percent if property assessment is used. The median is 12 percent which occurs if a charge based on water volume, with sprinkling water excluded, is employed. As shown in Table 2, retail customers would also pay the most if property assessment is used and the least if the charge is based on a flat rate. Customers that are in the service industries would pay most if a BOD charge is used.

Industrial customers bear the heaviest burden (47 percent) when the charge is based on BOD and the lightest burden when the charge is a uniform rate (0.4 percent). The median burden for industry exists if the charge is based on water volume with no allowance for sprinkling (27 percent). A flat rate uniform charge on each customer places a small burden on industry because the number of industrial firms is very small, relative to the total number of sewerage customers. The burden on industrial customers is also low if sewerage costs are financed by the proceeds of the property tax. This is partly because assessments are usually low due to the difficulty in determining the value of industrial property. The charge based on BOD places a large burden on industries because the concentration of BOD is higher for industrial wastes than for sanitary wastes.

Industrial customers that would pay the most under the BOD charge are those that produce chemicals (32 percent) and food (10 percent). These customers are large water users and also discharge effluents that have strong concentrations of BOD.

The category labelled "Other" includes chiefly hospitals, schools, and universities. These customers may not be subject to any sewerage charges by municipalities. If they are charged like all other customers, however, the charge would be the lowest under a uniform rate and the highest under a water volume charge, where there is an allowance for sprinkling. No burden is shown under the property assessment column because it is assumed that these customers would not be subject to the property tax.

Qualifications of the Model

The results presented in the previous pages may indicate a degree of precision that is not warranted. The figures in the table reflect the general magnitude of the relevant percentages but they are only estimates. There are four qualifications that should be explicitly noted.

First, the data in the tables are partly based on a specific city and the numbers would be different for most other cities. However, the relationship among columns would likely be similar for most municipalities. Consequently, attention should be focused on the relative magnitudes in each row rather than in the precise numbers.

Second, the data used in the analysis were not gathered for this model but were collected from many sources. Some of the statistics describe an Eastern city, some describe an area in the midwest, and some describe the entire United States. Collectors of the data include various branches of the Federal Government, a city government, and a consulting firm. Combining these divergent pieces of data introduces an unknown amount of error into the results.

Third, and more important, these results do not measure the response of customers to various charges. If a BOD charge was implemented it may be that businesses would reduce the amount of the BOD that they discharge. If the residential and commercial customers did not react in a similar manner, the percentage of revenue, but not necessarily the total revenue obtained from them, would increase. The city modelled currently charges most of its customers on the basis of water volume, so these results indicate an "after adjustment" distribution of revenue burden.

Fourth, the charges in the model are not as complex as the ones that currently exist in many municipalities. Municipalities that charge on the basis of water volume generally have minimum charges and a schedule of rates that declines with the volume. As compared to a charge of this nature, the charge used in the model tends to underestimate the burden on residential customers and overestimate the burden on industrial customers. The opposite is likely true for flat charges. No municipality as large as the one in the illustration would use a uniform flat rate. It is even unlikely that a city of this size would employ a modified flat rate. If a flat rate that varies by type of customer is employed, however, the burden on industry would rise and the burden on residences would fall as compared to the situation under a uniform flat rate. Municipalities that charge in relation to BOD, have volume in the charge formula as well. In addition, only industrial customers are generally subject to the BOD charge.

INCIDENCE OF USER CHARGES

It was pointed out in the discussion of equity that the "ability to pay principle" is not an important factor in the examination of user charges. The incidence of these charges may, however, be at least a marginal consideration in choosing between user charges and other levies and among various user formulas.

The incidence of a tax or charge refers to the ultimate burden or final payer of the levy.(56) In some cases, it is not the individual or business who has the legal responsibility for the levy who actually bears the burden of the charge or tax. For example, many excise taxes, like the gasoline levy, are paid by businesses but the ultimate or final burden rests with the consumer of the taxed product.

The burden of user charges paid by businesses could be shared by three groups of individuals. The burden of the charges could be shifted forward to the consumers of products sold by businesses through higher prices. It could be shifted backwards in the production process, chiefly to workers, in the form of lower wage, interest, and rental payments. The charges many also remain unshifted. In this case, the burden is borne by the owners of the businesses who obtain reduced profits. In measuring the incidence of the charges, the test is not whether prices, wages, and products change but how much of any change can be associated with a user charge.

The distribution of the burden among these groups depends on many factors. One important factor is the supply and demand conditions in (1) the markets for the products sold by businesses and (2) the markets for resources such as labor. A second factor is the length of the period analyzed during which price and wage adjustments could be made. In general, the longer the period after a charge has been introduced the more likely it is that the charges are shifted. The charge is also more likely to be shifted if the charge depends on the level of output, rather than a fixed amount.

The allocation of the burden among the three groups - consumers, business owners, and resource owners (chiefly workers) - has a weak but varied impact on the income distribution. User charges tend to increase income differences if shifted forward to consumers, reduce differences if unshifted, and have a mixed effect if shifted backwards.

The burden of user charges paid by residential customers is likely to be unshifted, and consequently, borne by them. It is likely that all of the charge formulas discussed in this report take a smaller proportion of income as the level of income rises. Each of these charge methods also tends to increase income differences more than a property tax which raises the same amount of revenue.

In this section of the report, several types of service charges have been examined. However, no general recommendation can be given. Each charge method has some virtues and some defects A municipality, when choosing a charge formula, has to examine the alternatives in the light of its own situation. In particular, such evaluations must examine the trade-off between administrative simplicity and equity. A water use charge appears to be a good compromise choice if water is already metered. In cases where water is not metered, a modified flat rate may be best. In cases where a variety of industrial wastes form a large part of the sewage brought to a treatment plant, such as may occur in a regional system, a charge based on both volume and strength of waste may be appropriate.

APPENDIX

This appendix supplements Section One on the current position of user charges. The description of existing user charge practices presented in Section One is based on the existing literature. This literature includes studies which were conducted in the 1953-1962 period, journal articles, and State reports.

State comparisons were not presented in Chapter One because reports were obtained for fewer than half the States and the material was not reported on any consistent basis. The reports differ in terms of proportion of municipalities included, the type of information presented, and the year in which the statistics were obtained. Some of the reports include nearly all of the municipalities in the States, while others only include a sample of the large cities. All of the reports indicate the basis of the user charge, some indicate the variation in charges that are levied against different categories of users, but very few reports give any indication of the revenue obtained and the costs of the sewerage system.

The following pages summarize the twenty-one available State reports on a State by State basis. The scope, topics, and detail given in the summaries vary from State to State due to differences in the reports.

ALABAMA(23)

Information on user charges in Alabama is taken from a report of the Alabama Water Improvement Commission. The data were collected during 1960 and 1961.

The Alabama report includes service charge information on 135 municipalities. Forty-eight municipalities do not have a service charge and 25 of the 48 do not provide sewage treatment. Some of these municipalities that do not have a sewer service charge have a water charge that is high enough to cover some of the costs of the sewer system. Of the 87 municipalities with sewer service charges, 21 do not provide treatment. These 21 municipalities charge a flat monthly fee and use the proceeds of the charge to finance the operation and maintenance costs of the collection system.

The most frequently used method of charging for sewage service is a flat fee. Over 60 percent of all local units use this method, including all with populations under 2,500. Municipalities with populations over 10,000 tend to rely on charge methods that are based on water use. Many of the municipalities that base the charge on water volume are served by Birmingham and Bessemer, both of which charge according to water volume. The following table shows the number of municipalities using each charge method:

TABLE 3

1961 SEWERAGE CHARGES IN ALABAMA
BY NUMBER OF LOCAL UNITS

	Basis for Charge			
Population	Flat Rate	Water Volume	Percentage of Bill	Total
Over 100,000		1		1
10,001 - 100,000	2	5	9	16
5,001 - 10,000	10	7	4	21
2,501 - 5,000	16	7	0	23
Under 2,500	26	0	0	26
TOTAL	54	20	13	87

Source: A Summary of Municipal Water and Sewer Rates, State of Alabama Water Improvement Commission, 1961.

The range in flat monthly rates is from $.50 to $2.50 and the median is $1.00. A few of the municipalities that charge a flat rate to residential customers levy a charge based on volume to commercial customers.

For municipalities that base the charge on a percentage of the water bill, the percentage ranges from 25 to 70 percent and the median is 50 percent. Nearly all of the local units that charge according to water volume have a schedule that declines as the quantity of water increases and all of these municipalities have a minimum charge. The minimum ranges from $.43 to $3.00 per month and the median rate is about $1.70. The following table has been constructed to show the range of charges and the median charge at various volumes of water. All of the municipalities included in the table charge on the basis of water volume or the water bill.

Several of the municipalities levy surcharges on industrial waste. Anniston has no sewerage charge except for commercial and industrial waste that exceeds a Biochemical Oxygen Demand of 210 parts per million. The charge is related to the strength of the effluent. Boaz has a charge to industrial plants that is based on volume and strength. Decatur, Athens, and Jasper have an extra charge for firms discharging burdensome sewage.

TABLE 4

1961 SEWERAGE CHARGES AT VARIOUS WATER VOLUMES FOR ALABAMA MUNICIPALITIES

	Gallons Per Month			
	4,000	12,000	50,000	200,000
High Charge	$2.04	$5.50	$16.84	$45.00
Median	.90	2.00	7.40	23.75
Low Charge	.52	1.14	3.62	12.89

Source: A Summary of Municipal Water and Sewer Rates, State of Alabama Water Improvement Commission, 1961.

Approximately 60 percent of the municipalities charge a flat sewer tap fee. This fee ranges from $1.50 to $225.00. The most common fee charged is $50.00. Decatur bases its fee on the size of the sewer. The charge ranges from $250.00 for a four inch sewer to $1,125.00 for a ten inch pipe.

Some information is also given on the type of bonds that are issued to finance treatment plants and connection systems. In financing sewage treatment plants and outfall sewers, 61 municipalities issued revenue bonds and 44 used public improvement bonds and 48 issued other forms of bonds. In approximately 40 percent of the local units, property is assessed to pay for the collection system.

FLORIDA(24)

Information on user charges in Florida is taken from a 1967 survey conducted by the Florida League of Municipalities. The Florida report is based on the survey and it includes information on 125 municipalities.

Over 60 percent of reporting Florida municipalities base the sewer service charge on a flat rate. Of these, three-fifths vary the charge by the number of residential units. For the 39 percent not charging on a flat rate, approximately 21 percent charge on water volume, 9 percent use a percentage of the water bill, and most of the remaining 9 percent charge on the number of plumbing fixtures attached to the system.

The monthly rate for a single residence is in the $2-$3 range for most municipalities. The rate for additional residences is generally the same or a little below the rate charge for a single dwelling. In Pompano, for example, the rate is $2.75 for each residence. In Edgewater, the rate is $3.50 for a single residence and $2.50 for each additional unit. Small municipalities that employ a fixed charge often charge commercial establishments the same rate. Large municipalities tend to charge a higher flat rate for commercial establishments or else switch to a charge based on water use.

Municipalities that base the charge on water volume also have a minimum rate. Most of the minimum charges are in the $2-$3 range. The price per thousand gallons declines as the quantity of water increases in nearly every municipality.

In local units where a percentage of the water bill is used as the basis for the user charge, the percentage ranges from 75 to 110 and the median is 100 percent.

Some of the municipalities that charge in relation to the number of plumbing fixtures have a minimum monthly charge and other local units charge at flat rate for each fixture. For example, Wauchula charges $2.50 for the first six fixtures and $.25 for each fixture between seven and twelve. Tallahasse has a charge of $.75 for each fixture. The price per fixture declines in many municipalities; in West Palm Beach, the price for the first four fixtures is $1.50 and $.25 for each of the next six. A few municipalities combine a charge for fixtures with one of the other charge methods. Tallahassee, in addition to charging $.75 per fixture, charges in relation to water volume.

More than 80 of the 125 municipalities have a connection charge. Most of the connection charges are a flat fee, but 11 base the charge on street surface and lot frontage, and three base the charge on sewer pipe size. The range in flat fees is from $2 to $300 and the median is approximately $75. In a few of the local units, both connection and service charges are higher for outside customers than for those residing within the municipality. The charge is 100 percent higher for outside customers in one or two cases but the typical increase is 25 percent.

Florida municipalities raise a substantial amount of revenue from user charges. Seven cities received more than $500,000 from this source in 1967. Tampa received over $3 million, Miami almost $2 million, Saint Petersburg nearly $1 million, Fort Lauderdale $875,000, Daytona Beach $658,000, Lakeland $634,000, and West Palm Beach $590,000. In per capita terms the range is from less than $1 to nearly $60. Most of the municipalities obtained yields between $8 and $17 and the median yield is approximately $12.

GEORGIA(25)

The description of user charges in Georgia is taken from a study by the Georgia Municipal Association in 1965. The study is limited to cities with population between 5,000 and 10,000. Data on sewer service rates are given for 21 cities.

Five of the cities make no charge for the sewage services that are provided for residential customers residing inside the municipalities. Two of these five cities do make flat monthly charges to outside customers, however.

Twelve of the cities levy flat monthly charges to residential customers residing inside the city boundaries. The charge ranges from $.75 to $6.00. All except one of the cities charge from $.75 to $1.00. Two of these cities charge commercial and industrial customers a percentage of the water bill and a third municipality bases the commercial charge on the number of sewer connections.

Two of the municipalities charge on the basis of the water bill. In Monroe, each customer is charged a monthly amount equal to one-half of the monthly winter water bill. Elberton charges residential, commercial, and industrial customers an amount equal to 40 percent, 25 percent, and 5 percent of the water bill, respectively.

One municipality charges in relation to water volume and the remaining city included in the survey, Rifton, charges residential customers in relation to the number of taps, and commercial customers in relation to the number of taps and volume of water.

The arrangements regarding the acceptance of industrial waste vary among cities. Five cities accept industrial wastes with no extra charge; three accept with payment on a volume or strength basis; two accept waste with industry paying capital cost of additions to the treatment facility necessitated by wastes; two accept wastes with industry paying a surcharge if the strength is above that of domestic waste; and, three refuse to accept industrial waste.

IDAHO(26)

The information on municipal sewerage charges in Idaho is taken from a report of the Idaho Municipal League entitled Idaho Water and Sewer Rates, January 1966. The report includes over 50 municipalities but information on charges is given only for approximately 30 local units.

The most common basis for charges in Idaho municipalities is a flat monthly amount to all customers. Approximately one half of the municipalities charge on this basis. Another quarter of the local units use a monthly charge, but vary the charge according to the number of residences in a building and the type of commercial establishment served by the system. Most of the remaining municipalities charge according to the quantity of water purchased, but a few use a percentage of the water bill and other forms of charges. A few of the local units use a combination of charges. Residences and small commercial establishments are charged a flat amount and large businesses are charged in relation to quantities of water used. The municipalities which employ charges based on water use also generally have a minimum charge. As is true in most States, it is the smaller municipalities which use the flat monthly charge method.

For municipalities levying a flat charge per month or quarter, the average charge is approximately $1.75 per month. The largest number of municipalities charge $1.50 but a few charge substantially more than this. Some of the local units that vary the monthly charge by the type of establishment have only two or three categories and others such as Kamiah have a very detailed list of categories. The charge for most commercial establishments is less than twice the charge for single family homes. For municipalities that charge in relation to water use, the rate declines as the amount of water used increases. For example, Boise has a minimum charge of $.80 and charges $.13 for the first 1000 cu. ft. The rate then declines to $.09 for amounts over 5,000 cu. ft.

IOWA(27)

The information on Iowa is taken from a 1959 report of the Iowa State Department of Health on municipal sewer rental ordinances. This material is supplemented by 1968 statistics for 19 municipalities. Some municipalities have no doubt changed the form and amount of their sewerage rates since 1959. However, using other States as a guide, it seems safe to conclude that at least three-fourths of the local units are currently employing the same charge as they did in 1959.

Charge methods based on water use are very prevalent in Iowa. All of the municipalities with population over 2,500 and approximately 85 percent of all local units base the sewerage charge on water use. The remaining 15 percent of the municipalities levy a flat fee. Nearly two-thirds of the local units employing a water use measure base the charge on the water bill and the other one-third charge according to the volume of water. The following table illustrates the distribution of charge methods by size of municipality.

TABLE 5

1959 SEWERAGE CHARGES IN IOWA
BY NUMBER OF LOCAL UNITS

	Charge Basis			
Population	Flat Rate	Volume of Water Used	Percentage of Water Bill	Total
Over 100,000		1		1
10,001-100,000		8	8	16
5,001-10,000		5	7	12
2,501-5,000		8	13	21
1,000-2,500	10	11	24	45
Under 1,000	12	6	21	39
TOTAL	22	39	73	134

Source: Sewer Rental Ordinances in Iowa Cities and Towns, Iowa State Department of Health, Division of Public Health Engineering, January 1959.

For the municipalities basing the charge on a percentage of the water bill, the range in percentages is from 10 to 100 percent. Over two-thirds of the local units use a percentage between 25 and 50 percent and the median is 40 percent. Many of the municipalities also levy a minimum charge that is roughly \$.50 per month.

The local units which base the charge on the volume of water generally have a rate schedule that declines as the quantity of water increases. There is, however, a higher percentage of municipalities in Iowa that charge a flat rate per gallon than in most States. The rate per gallon commonly ranges between \$.05 and \$.10 per thousand gallons. Nearly all of the local units that base the levy on water volume have an additional flat fee or minimum charge. The flat fee generally ranges between $.50 and $1.00 per month.

The municipalities that charge a flat fee for residences often have a schedule of rates for commercial customers. For example, Lake Mills charges residences $1, schools $50, a creamery $30, and banks $2 per month.

Surcharges for industrial effluents are much more prevalent in Iowa than in most other States. More than ten municipalities have explicit charges for industrial effluent above a certain strength and another 20 to 30 local units have provisions for making extra charges for industrial wastes. These charges take many forms. In Charles City and Hampton the Biochemical Oxygen Demand (BOD) above 400 parts per million is multiplied by the volume of sewage and a rate of $.002 per gallon. Boone ranks industries on a BOD scale and charges an industry a higher percentage of the water bill the higher it is on the scale. Des Moines takes into account both BOD and suspended solids in its charge scheme. Iowa City, which bases its sewerage charge on the volume of water, varies the rate according to the BOD of the industrial effluent. Coon Rapids gives a credit for unpolluted water.

KANSAS(28)

The material on Kansas is taken from the 1968 League of Kansas Municipalities report titled: Sewage Service Charges in Kansas Cities.

Many of the current sewerage charges levied by Kansas municipalities are derived from recently enacted ordinances. Nearly all of the municipal ordinances pertaining to sewerage charges were enacted since 1955 and the majority of the ordinances were enacted after 1960.

A flat monthly rate is the most frequently used sewerage charge in Kansas. Second in frequency of use is volume of water, and the percentage of water bill charge ranks third. As is true in most States, nearly all of the small municipalities employ a flat rate charge. The following table indicates the use of the various charge methods by Kansas municipalities:

TABLE 6

1968 SEWERAGE CHARGES IN KANSAS
BY NUMBER OF MUNICIPALITIES

	Basis for Charge			
Population	Flat Rate	Volume of Water Used	Percentage of Water Bill	Total
Over 50,000	1	2		3
25,001-50,000		2		2
10,001-25,000	6	9		15
5,001-10,000	3	5	2	10
2,501-5,000	24	8	5	37
1,000-2,500	43	6	3	52
Under 1,000	87	5	4	96
TOTAL	164	37	14	215

Source: League of Kansas Municipalities, Sewerage Service Charges in Kansas Cities, June 1968.

The rates vary among municipalities that employ the same method of charging for sewage services. The flat rates vary from $.25 to $5 per month. The median monthly charge is approximately $1. Nearly all of the municipalities which base the user charge on volume of water have minimum charges. The median average charge is $1 per month but the amount ranges from $.70 to $2.50. Some of the municipalities charge for water at a fixed rate per gallon or cubic foot and others charge at a declining rate as more water is used. A common fixed rate is $.10 per thousand gallons. For municipalities that base the charge on a percentage of the water bill, the median percentage is 50 percent and the range is from 20 percent to 100 percent.

The above statistics are for a single family within the city. Many of the municipalities that use a flat rate also increase the charge for multiple family units. The increased charge usually takes the form of increasing the rate, often 100 percent. A few municipalities that levy a flat charge on single family dwellings also levy a charge on water use for multiple dwellings.

Nearly half of the municipalities charge customers outside the city more than those inside. The extra charge varies from one municipality to another. The highest extra charge is 100 percent and the average additional charge is approximately 50 percent.

There are no revenue figures given in the Kansas report but using average family water use statistics, it appears that per capita revenue from residential customers is lower for municipalities that use a flat rate charge than for those local units that base the charge on water use.

MICHIGAN(29)

The description of user charges in Michigan is taken from a bulletin published by the Michigan Municipal League in 1959. It is likely that many of the municipalities have changed their charges in the last nine years.

Flat rate charges are less frequently used in Michigan than in most other States. Less than six percent of all municipalities charge a flat amount. Over 85 percent of the local units base the charge on water use. Sixty percent use water volume and another 25 percent base the charge on the water bill. One large municipality, Bay City, charges according to the size of the water meter. The following table presents the distribution of charge methods among municipalities:

TABLE 7

1959 SEWERAGE CHARGES IN MICHIGAN
BY NUMBER OF LOCAL UNITS

	Basis for Charge				
Population	Flat Rate	Volume of Water Used	Percentage of Water Bill	Other	Total
Over 50,000		8	1	1	10
25,001-50,000		8	3		11
10,001-25,000	1	15	2	2	20
5,001-10,000		9	9	1	19
2,501-5,000	3	9	6	2	20
Under 2,500	2	12	5		19
TOTAL	6	61	26	6	99

Source: Sewer Service Charges and Related Data in Michigan Municipalities, Michigan Municipal League, Information Bulletin No. 91, October 1959.

Nearly all of the municipalities that charge in relation to water volume have minimum charges. The minimum charges are related to meter size much more frequently than in other States. The minimum monthly charge for a one family residence is approximately $1 in most local units. Although most of the municipalities have a rate schedule that declines as the quantity of water increases, flat rate charges per 1,000 gallons or 100 cubic feet are more common in Michigan than in most other States. The flat rate per unit of volume varies from $.05 to $1.00 for 1,000 cubic feet of water.

For municipalities charging on the basis of the water bill, the percentage ranges from 40 to 200 percent but most of the percentages are concentrated from 40 to 100 percent. The median is 50 percent.

Approximately one-half of the municipalities charge a connection fee. However, the proportion of local units charging a fee is not the same in each population category. Nearly all of the municipalities with population under 2,500 employ a charge but most of the local units over 2,500 provide the service free. Many have a variable charge. The fixed charges range up to $300. The median fixed charge is about $90.

Forty-five municipalities have extra charges for customers residing outside the municipal boundaries. The ratio of outside to inside charges varies a great deal among the municipalities. Nine charge the regular inside rate, 10 charge 150 percent and 19 charge 200 percent of the regular rate. Seven other local units have different forms of extra charges to outside customers. Kalamazoo, for example, charges according to property valuations.

Several of the municipalities provide adjustments in the charge for domestic users. The most common example of this is the allowance for sprinkling. Seventeen municipalities base the charge on the winter water consumption. Others make adjustments for air conditioners and water that is not discharged into sanitary sewers.

Thirty-one of 82 municipalities require industries to pretreat at least some of the wastes. Twenty-eight of these local units require pretreatment before the waste can be discharged into any body of water. Six municipalities have extra charges for industrial waste. The charges are based on the strength or concentration of the sewage.

The Michigan report gives some financial data on user charges and the sewer system. Data on per capita revenue from sewer service charges is given for 69 municipalities. Twenty obtain $7 and above, 25 receive from $4 to $6.99, 17 obtain $2 to $3.99, and 7 receive less than $2. On the expenditure side, data on per capita operation and maintenance costs are given for 57 municipalities. The cost is $7 or more for eight municipalities, from $4 to $6.99 for 18 local units, $2 to $3.99 for 20, and less than $2 for 11 municipalities. Therefore, an average municipality covers all of the operating and maintenance costs with sewer service charges and has about $1 per capita left to cover debt service charges. Many municipalities gave more than one answer to the query about the purpose of the charges. The most frequently mentioned purpose was to provide funds for the operation of the treatment plant (63 out of 93 municipalities). This answer was closely followed by "retire revenue bonds" (51 municipalities) and "operation of sewer systems" (46 municipalities).

Eighty-five local units also indicated the source of funds for construction of the sewage treatment system. Forty-five issued general obligation bonds and 40 sold revenue bonds. In general, the municipalities over 5,000 population issued revenue bonds and the local units under that size relied on general obligation bonds.

MINNESOTA(30)

The description of sewerage charges in Minnesota is taken from a report written by the League of Minnesota Municipalities and Municipal Reference Bureau. The report includes information obtained in a 1965 survey. The report also compares the results of the 1965 survey and a previous survey conducted in 1959.

According to Minnesota legislation, municipalities are allowed to finance sewer improvements by issuing general obligation bonds payable from general taxes, special assessments, sewage service charges, and other non-tax revenues. The service charges can be based on the cost of the sewerage service, the quantity of water consumed, the quantity and quality of the sewage, a classification of the premises served by the system, and by any other equitable basis. All of the revenue received from sewerage charges, sale of sewerage facilities or sewage must be placed in a separate fund. The fund must be used first to cover operating and maintenance costs. Any revenue remaining may be used to service the sewerage debt.

Minnesota municipalities tend to rely on charges based on water use more than the municipalities in most States. Thirty-four percent of the municipalities use a percentage of the water bill and 20 percent base the charge on water volume. Forty-five percent use a flat rate and the remaining one percent charge according to the size of the water meter. A table presenting the distribution of municipalities by charge method and population size is shown below.

TABLE 8

1965 SEWERAGE CHARGES IN MINNESOTA
BY NUMBER OF MUNICIPALITIES

	Basis of Charge				
Population	Flat Rate	Volume of Water Used	Percentage of Water Bill	Other	Total
Over 100,000		2		1	3
10,001-100,000	8	9	5		22
5,001-10,000	1	4	9	1	15
2,501-5,000	11	3	17		25
1,001-2,500	21	7	15		43
Under 1,000	22	1	6		29
TOTAL	62	26	46	2	136

Source: Information for Municipal Officials: Sewer Service Charges (sewer rentals) in Minnesota Municipalities, League of Minnesota Municipalities and Municipal Reference Bureau, Revised December 1965.

Most of the municipalities that employ a monthly or quarterly flat levy charge a monthly rate between $.50 and $2.50. Fifty-four of the 62 municipalities are in this range. The rate for each unit in multiple-unit dwellings tends to be lower than the rate for single family dwellings in most municipalities. For example, Columbia Heights charges $1.25 per month for a single family and $.75 for each additional family. Approximately 15 of the 62 municipalities change to a charge based on water use for commercial and industrial customers. They divide about equally between using the water bill and the volume of water. These local units that change the basis of the charge are the larger municipalities. Most of the smaller municipalities charge the commercial customers the same rate as the residential customers. Consequently, very few

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of the Minnesota municipalities have the detailed classifications of commercial establishments that are found in many other States.

For municipalities employing the percentage of water bill method, the percentage ranges from 25 percent to 140 percent. The median rate is 50 percent but there also is a substantial number of local units at 100 percent.

St. Paul and Litchfield base the user charge on the size of the water meter. In St. Paul, the monthly rate varies from $1.50 for a five-eighths inch meter to $181.20 for a 12 inch meter for customers inside the city. The rate ranges from $2.50 to $298.20 for outside the city.

There are a few Minnesota municipalities that have surcharges for industrial wastes. In the case of small municipalities, the surcharge is related to a specific industry. Winnebago, Rochester, Duluth, Owatonna, and Fergus Falls all base the charge on the volume and strength of the industrial effluent. Other municipalities such as Mora and Lake Benton have provisions for levying a special charge on industrial wastes.

The Minnesota report made some comparisons of its 1959 and 1965 surveys that give some indication of trends in user charges. Forty percent of the municipalities made no changes in their sewer rates for residential customers. Eighty percent of those municipalities that changed their charges only altered the rate and not the basis for the charge. The 16 municipalities that did change charge formulas are distributed as follows: three changed from a flat charge and two from a percentage of the water bill to water volume, one changed from water volume and eight from a flat rate, to a percentage of the water bill and two changed from percentage of the water bill to a flat rate. This represents a net change of 14 from a flat rate to a water use method. In terms of commercial charges, the net change is 13. The change from a flat rate to a charge based on water use has occurred primarily in larger municipalities where there has been an influx of industry.

MISSISSIPPI(31)

The Mississippi State Board of Health provided the information regarding municipal sewer charges in Mississippi for 1965. This report is based on forms filled out by the municipalities for the State Board of Health.

The most commonly used basis for sewerage charges in Mississippi is a percentage of the water bill. This charge basis is chiefly utilized by the larger municipalities and by the smaller municipalities in which the commercial and industrial users are important. The smaller local units tend to employ a flat rate charge if the sewer system is primarily used by residential customers. The following table illustrates the number of municipalities employing each type of charge by population size.

TABLE 9

1965 SEWERAGE CHARGES IN MISSISSIPPI
BY NUMBER OF MUNICIPALITIES

	Basis for Charge		
Population	Flat Rate	Percentage of Water Rate*	Total
Over 50,000	1		1
25,001-50,000	1	3	4
10,001-25,000	1	6	7
5,001-10,000	3	10	13
2,501-5,000	7	5	12
1,000-2,500	10	20	30
Under 1,000	18	5	23
TOTAL	41	49	90

*There may be some charges based on the quantity of water used included in the percentage of water bill category.

Source: Municipal-Residential Sewer Rates, Mississippi State Board of Health, 1965.

The rates charged vary within each category. Many municipalities have a different rate schedule for customers inside the city than for customers located outside the municipality. The outside rate is almost always higher and in some cases no charge is made to inside customers. The largest difference appears to be in Lucedale where insiders are charged an amount equal to 50 percent and outsiders are charged 150 percent of the water bill. Also, the charge varies among cities. The median inside rate for municipalities employing the percentage of water rate basis is 33 percent of the water rate but the range is from 5 to 67 percent. The median flat rate is between $1 and $2 per month and the range is from zero to $3 for inside customers. The maximum flat rate for outside customers is also $3. Several of the municipalities have a maximum amount that can be levied against customers who are charged according to their water bills. A common maximum is $5.00 per month.

NEBRASKA(32)

The information on Nebraska is taken from a survey published by the League of Nebraska municipalities, December 1964.

Water use is the most frequent basis for sewerage charge in municipalities above 500 population. The smaller cities and villages depend almost entirely on a flat monthly charge. Although nearly all of the first class cities (population 5,000 or more) levy a service charge almost a quarter of the smaller cities and villages make no charge for sewage services. The following table describes the pattern of charge methods among municipalities.

TABLE 10

1964 SEWERAGE CHARGES IN NEBRASKA
BY NUMBER OF MUNICIPALITIES

	Basis of Charge			
Population	Flat Rate	Volume of Water Use	Percentage of Water Bill	Total
Cities				
5,000 & Over	7	5	4	16
Under 5,000	37	2	5	44
Villages	53	2	-	55
TOTAL	97	9	9	115

Source: William L. Wilke Survey of Rates Charged for Electricity, Water, Gas, and Sewerage, The League of Nebraska Municipalities in cooperation with the Department of Economics of the University of Nebraska, December 1964.

Most of the first class cities employing a flat charge vary the charge according to the type of customer. For example, in Columbus the monthly rate varies from $1 for residences to $9 for factories. York has a $1 charge for residences and a rate schedule for business that ranges from $1.10 to $75. The municipalities that base the charge on water volume generally have a minimum charge of $1, and a schedule of rates that declines with the quantity of water. Municipalities that charge in relation to the water bill levy a monthly charge that ranges from 20 percent of the March water bill to 75 percent of the average monthly bill for the winter months. A frequently used value is 50 percent.

The flat monthly charge used by small cities and villages ranges from $.35 to $3 per month. The average charge per month is about $1.50.

Nearly one half of all the municipalities in Nebraska tie some of the property tax proceeds to financing the sewerage system. The villages attach a higher mill rate to sewers than do the cities. The mill rate for most of the cities is about one mill but some of the villages devote six to eight mills.

NEW YORK(33)

The information on user charges in New York is taken from a report prepared by the New York State Conference of Mayors and other municipal officials. The New York report is based on a questionnaire survey conducted in 1966. There were 23 cities and 95 villages that responded to the survey.

New York municipalities tend to place less emphasis on sewerage charges than local units in other States. This absence of user charges is especially noticeable in cities. Eight out of 23 cities and 31 out of 95 villages do not levy service charges. The cities include Albany, Syracuse, and Corning. Another five cities and 19 villages charge only customers residing outside the municipality.

Nearly all of the municipalities base the charge on water use. Six cities and 21 villages use a percentage of the water bill. Three cities and 11 villages base the charge on the volume of water. The remaining municipalities levy a flat rate or base the charge on assessed valuation of the property and the number and type of fixtures. One city, Plattsburgh, and 13 villages levy a flat rate. Three villages and the city of Buffalo, which uses several charges, base the levy on the assessed valuation of property. Four villages that use a flat rate for residential customers change to water volume for commercial units.

The percentages used by municipalities that base the charge on the water bill vary from 25 percent to 100 percent for cities and 25 percent to 106 percent for villages. The median percentage for cities is between 70 and 75 percent and for villages 50 percent.

For municipalities that levy a flat rate, the charge per month ranges from $10 for Geneseo to less than $1 for Waddington. The median charge is between $4 and $5.

Basing the user charge on assessed valuation is similar to using property tax proceeds to cover sewer costs. Making a separate charge on property for sewers does, however, indirectly tie sewer revenues to sewer costs. The rate varies from one municipality to another, depending on costs and assessments. One example, Patchogue, charges a rate of $.99 per $100 of assessed value.

New York municipalities tend to charge outside customers more in relation to inside customers than do the municipalities in other States. It is common for outside rates to be twice as much as inside rates and, occasionally, outside customers are charged more than three times the amount charged inside customers.

NORTH CAROLINA(34)

The user charge information for municipalities in North Carolina is taken from a survey conducted by the North Carolina League of Municipalities in 1964. This information is more limited than for most States, however, because the survey covered only the municipalities with populations over 10,000.

Nearly all of the 28 cities included in the survey use a percentage of the water bill as the basis for the charge. The only city with a population over 25,000 that does not use this method is Asheville, which has no sewerage service charge. All of the cities with a population between 10,000 and 25,000 base the charge on the water bill, except Hickory, which levies a flat monthly charge. The percentage of the water charge varies from 25 percent to 100 percent. For the cities over 25,000 in population, the range is 50 percent to 100 percent and the median is 60 percent. The range for the cities with populations between 10,000 and 25,000 is 25 to 75 percent and the median is 40 percent. The rate for outside customers ranges from 150 to 250 percent of the rate for inside customers. The typical outside rate is double the inside rate.

Approximately one quarter of the cities base the minimum charge directly on the size of the water meter. Greensboro's minimum monthly charge which varies from $.85 for a five-eighths inch meter to $95.55 for an eight inch meter indicates a typical schedule of rates.

Most of the cities charge a connection fee that depends on one or more of these variables: (1) the size of the pipe; (2) the condition of the street; and (3) the location of the customer. The highest rates are charged to customers who are located on paved streets outside the city and who require a large sewer pipe. A paved street adds from 20 to 100 percent to the connection charge and a customer will pay from 30 to 80 percent more if he is located outside the city. In Fayetteville, for example, the connection charge for a four inch sewer is $110 inside the city and $150 outside the city. In Winston Salem the charge for the same sized sewer is $115 if the street is paved and $75 if not paved.

NORTH DAKOTA(35)

The information on the sewer service charges levied by North Dakota municipalities is derived from a bulletin published by the League of North Dakota Municipalities. The bulletin describes the rates that existed March 31, 1963.

Nearly all of the municipalities with populations over 2,500 base the service charge on water use. Municipalities under 2,500 utilize a flat monthly charge. The distribution of charge methods by size of municipality is presented in table 11.

The municipalities basing the levy on water volume all have minimum charges. The minimum charge ranges from $.45 to $2.75 per month for residential customers and from $.50 to $3.25 for commercial customers. For local units that use a percentage of the water bill, the percentage ranges from 10 to 30 percent.

Nearly all of the municipalities that employ a flat levy charge a higher rate for commercial customers than for residential customers. In many cases, the charge for a commercial customer depends on the business of the customer. The charge for residential customers range from $.25 to $3 at a monthly rate. The median charge is about $1. For commercial customers, the range is from $.25 to $25 and the median rate is roughly equal to $2. The variation in rates is greater among the smaller municipalities but the average rate is lower.

TABLE 11

1963 SEWERAGE CHARGES IN NORTH DAKOTA BY NUMBER OF MUNICIPALITIES

Population	Basis of Charge Flat Rate	 Volume of Water Use	 Percentage of Water Bill	 Total
Over 2,500	2	10	2	14
1,501-2,500	10	3		13
1,001-1,500	18	4		22
500-1,000	33		2	35
Under 500	57	1	1	59
TOTAL	120	18	5	143

Source: Water and Sewerage Rates in North Dakota Cities and Villages, as of March 1963, League of North Dakota Municipalities, Special Bulletin No. 33, July 1963.

OHIO(36)

The summary of user charges in Ohio is based on a 1962 report published by the Ohio Department of Health. The report includes material on over 340 municipalities.

The most common form of sewerage service charge in Ohio is one based on water volume. Approximately 50 percent of the local units base the user charge on the volume of water used. Most of these municipalities have a schedule of rates that declines as the quantity of water increases but approximately 10 percent of the local units charge a flat rate per cubic foot or 1,000 gallons of water. The remaining 50 percent of the municipalities are almost evenly divided between a flat charge and a levy based on the water bill. Of the municipalities levying a flat amount per month or quarter, two-thirds charge the same amount to all customers, and one-third have a rate schedule that differentiates among various types of property (e.g. schools, apartments, retail stores, etc.). The following table illustrates the number of municipalities employing each charge method.

The municipalities that base the charge on the water bill indicate a wider variation in the percentage used than do the municipalities in most other States. The range in percentages is from 15 to 200 percent and the median is between 60 and 70 percent. For the municipalities that charge a flat rate per unit of volume, a common charge is $.225 per cubic foot.

TABLE 12

1962 SEWERAGE CHARGES IN OHIO
BY NUMBER OF MUNICIPALITIES

	Basis for Charge			
Population	Flat Rate	Volume of Water Used	Percentage of Water Bill	Total
Over 100,000		7	1	8
10,001-100,000	7	52	28	87
5,001-10,000	6	31	15	52
2,501-5,000	14	26	18	58
1,000-2,500	40	49	20	109
Under 1,000	16	12	5	33
TOTAL	83	177	87	347

Source: Status of Sewer Rental in Ohio, Ohio Department of Health, May 1962.

All of the municipalities have a minimum or flat charge. On a monthly basis this ranges from $.13 to $5. The median is between $1 and $1.50.

The primary purpose of the recently created Ohio Water Development Authority is to aid in financing facilities to control water pollution. The Authority has the power to acquire, construct, maintain, and operate water pollution control facilities and make them available to private industries and municipalities. These facilities are to be financed through revenue bonds issued by the Authority. In November 1968, a $120 million bond issue was passed for water pollution control and water development (the allocation of funds is to be made by the Assembly). Revenues used to pay debt service charges and operation costs are to be based on contracts between the Authority and the participating municipalities and industries.

OREGON(37)

The material for Oregon is taken from a survey conducted by the Bureau of Municipal Research and Service, University of Oregon, in cooperation with the League of Oregon Cities. The survey included 133 cities and 28 sanitary districts and most of the information was collected for the year 1964.

Oregon utilizes charges, special assessments, and property tax proceeds to meet the costs of sewers. Charges are used chiefly to meet the costs of treatment plants and to maintain the system. Special assessments are used in financing sewer laterals and the property tax proceeds are often used to retire bonds which were issued to provide construction funds.

Sewerage charges came into existence over 30 years ago in Oregon to help meet the construction and operation and maintenance costs of sewage treatment plants. Periodic surveys have indicated a growth in the use of municipal charges. There were 13 cities that used a charge in 1942, 102 cities by 1957, and currently 127 cities and 25 sanitary districts employ a service charge. There are two cities with populations over 5,000 that do not utilize charges. In many municipalities, one does not, in fact, have to use the sewer to be subject to the charge. In 44 of the cities, all with access to the sewer system are charged, and in 61 of the cities all water users are charged. In most instances, however, water users and those with access to the sewer system are connected to the system.

Most of the municipalities have separate charge schedules for residential and commercial customers. Thirty-nine municipalities used the same schedule for two types of customers and 88 used separate schedules. Some of the municipalities also levy a special surcharge on industrial waste that is above normal strength. For example, Salem's charge is based on volume, suspended solids, and biochemical oxygen demand.

Over 90 percent of the municipalities employ a flat charge for residential customers. For commercial accounts, flat charges are the commonly used basis, but water use, percent of water bill and type of business are also extensively used. The table shows the distribution of commercial sewer charges by size of municipality and sanitation district. The table also indicates the number of local units employing a special surcharge on industrial sewage of greater than normal strength.

As is true of most States, the larger municipalities tend to use the volume of water and a percentage of the water bill as the basis for a sewerage charge, and small municipalities base the charge on a flat rate. The table also indicates that the large municipalities utilize a special surcharge on industrial waste more than small local units.

TABLE 13

1964 COMMERCIAL SEWER CHARGES IN OREGON BY NUMBER OF MUNICIPALITIES

Population	Basis for Charge							
	Flat Rate	Volume of Water Used	Percent of Water Bill	Number of Fixtures	Type of Business	Other	Total	Special Surcharge for Industrial Sewage
Over 100,000			1				1	1
25,001 - 100,000		4					4	3
10,001 - 25,000	4	3	3	1			11	1
5,001 - 10,000	2	7	2		1		11	1
2,501 - 5,000	4	3	5	3	3	2	20	1
1,001 - 2,500	13	2	5	2	7	1	30	
501 - 1,000	13	1	1	2	9	2	28	
Under 500	8			1	1		10	
Total Cities	44	20	17	8	21	5	115	7
Sanitary Districts*	7	1		1	1		10	2

*Many sanitary districts did not indicate a charge for commercial units.

Source: Sewage System Financing and Service Practices: A Survey of Sewage Rates, Financing Policy and Service Practices in Oregon Cities and Sanitary Districts, Bureau of Municipal Research and Service, University of Oregon in cooperation with League of Oregon Cities, Information Bulletin No. 155, 1960.

All municipalities employing a charge have a minimum for residences. This charge ranges from $.25 to $5 per month. The minimum charge has increased over time. The median charge was $.75 in 1952, $1 in 1967 and rose to $1.75 in 1964.

Most cities charge a connection and/or a permit fee when the sewer connection is authorized. The permit fee is used to meet the cost of inspection. The connection charge is often used to offset the cost of the connection to the city. Over 70 cities and 11 sanitary districts charge a connection fee. The connection fee for cities ranges from under $20 to over $400, and the median is a little less than $100 for cities and approximately $250 for sanitary districts.

The revenue from sewerage charges is substantial in most local units. Portland obtained over $2 million and Eugene and Salem each received over $500,000 in 1964. Many of the municipalities in the 10,000-25,000 range of population obtained over $100,000. In per capita terms the high was the $46.65 obtained in Cannon Beach, and over 26 cities received more than $10. The per capita yield was between five and six dollars for most of the population groups in the table. Much of this revenue goes toward retiring bonds which were issued to obtain funds for the construction of the sewers and sewage treatment plants. In 1964 approximately 44 percent of the funds used for debt service funds came from sewerage charges. Debt service charges will be at a high level over a period of years because over 45 cities issued bonds for sewers and treatment plants in the 1959-64 period.

SOUTH DAKOTA(38)

The information on South Dakota is drawn from reports publiished by the University of South Dakota and the South Dakota Department of Health, in cooperation with the South Dakota Municipal League. The most recent report is based on a survey conducted in 1967. However, this report does not include any information on the revenue raised by service charges for cities under 500 population and these data are based on a 1964 survey.

Approximately one-third of the municipalities in the State do not have any sewerage service charges. Although most of these municipalities have populations of less than 500, some large cities including Aberdeen and Rapid City, have no sewage service charges. Nearly all of the first class cities (population exceeds 5,000) base the user charge on a percentage of the water bill but the most commonly used charge in South Dakota is the flat monthly charge. Approximately one-sixth of the municipalities employing a flat charge vary the charge by type of customer. For example, Lake Norden charges residences $1 and a creamery at a rate of $90 per month. Some of the municipalities that levy a flat charge on residential customers base the charge for commercial and industrial customers on water use. The following table illustrates the type of charges employed by South Dakota municipalities.

TABLE 14

1967 **SEWERAGE** CHARGES IN SOUTH DAKOTA BY NUMBER OF MUNICIPALITIES

	Basis for Charge			
Population	Flat Rate	Volume of Water Used	Percentage of Water Bill	Total
5,000 and over	1	1	6	8
500 - 4,999	34	5	7	46
Under 500	15	1	—	16
TOTAL	50	7	13	70

Source: Wastewater Facilities in South Dakota Municipalities, Statewide Educational Services, The University of South Dakota, in cooperation with the Department of Health. Report No 767, August 1967.

For the first class cities that base the charge on a percentage of the water bill, the percentage ranges from 35 percent to 100 percent of the average winter bill. Many of the muncipalities charging a flat rate base the charge on a quarter rather than a month. On a monthly basis, however, the charge ranges from $.33 to nearly $4. Most of the charges fall between $.50 and $1 per month.

The first class cities that employ user charges received between $33,000 and $78,000 in 1966.[5] In per capita terms, most of the cities obtained approximately $7. In nearly all cases, the municipalities believed that the yield was adequate in terms of meeting costs. For municipalities with population between 500 and 5000, the per capita yield varies greatly. Some municipalities obtain only about $1 per person. At the opposite end of the scale Mission receives $20. Wall receives more than $13 and Moonsocket more than $12. The median yield is approximately $5.

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[5] Sioux Falls did not begin its system of charges until after 1966.

The per capita yield for municipalities with populations below 500 ranges from $2 to over $20 with the median about $4. The municipalities that receive a high yield judge it to be adequate to cover costs but most of the local units receiving a low yield view the revenue as inadequate.

Some of the municipalities have issued revenue bonds to provide construction funds. These bonds are retired through the revenue obtained from the service charges. This method of financing sewerage systems has been used more by the smaller municipalities than by the larger cities. Although Sioux Falls expects to cover its construction costs with the newly instituted system of charges, most of the first class cities expect to rely on assessment and general obligation bonds.

TENNESSEE(34)

The description of sewerage charges in Tennessee is based on a 1967 report by the Tennessee State Planning Commission.

The report covers utility districts as well as municipalities. It is estimated that there are 180 utility districts in the State. They range in size from those serving 60 people to those serving many thousands. Most of them, however, do not appear to levy sewerage charges.

The most commonly used basis for service charges in Tennessee municipalities is a percentage of the water bill. Approximately 60 percent of the local units use this charge method. The next most popular method is a flat charge. Over 20 percent of the municipalities employ this form of user charge and the remainder base the charge on the volume of water. The following table illustrates the use of each method by size of the local unit.

The range in percentages for municipalities that charge on the basis of the water bill is from 10 to 100 percent. The median percentage is 50 percent. In general, large municipalities charge a higher percentage than do small local units.

Gatlinburg has an unusual charge scheme in that the percentage applied to the water bill rises as the amount of the bill increases.

For municipalities employing a flat monthly charge, the levy ranges from $.50 to $5. The median charge is approximately $2.

TABLE 15

1967 SEWERAGE CHARGES IN TENNESSEE
BY NUMBER OF LOCAL UNITS

	Charge Basis			
Population	Flat Rate	Volume of Water Used	Percentage of Water Bill	Total
Over 40,000		2		2
15,001-40,000	1	4	6	11
10,001-15,000	1	1	10	12
5,001 -10,000	1	5	14	20
3,001 - 5,000	3	3	14	20
1,000 - 3,000	8	5	26	39
Under 1,000	9	3	6	18
Utility Districts*	5	3	4	12
Total	28	26	80	134

* These vary in size

Source: Sanitary Services in Tennessee 1967, Tennessee State Planning Commission, Nashville, November 1967.

The municipalities basing the charge on volume of water all have minimum charges and a schedule of rates that declines as the quantity of water increases. The minimum charge is between $1 and $2 in most cases.

The majority of the Tennessee municipalities levy a tap or connection fee but many of the smaller municipalities appear to provide this service free of charge. The Nashville-Dawson County Metropolitan Government charges from $3 for a four inch sewer to $1,000 for a 12 inch sewer, but nearly all of the municipalities charge $100 or less.

The revenue yield from user charges is given for some of the municipalities in the Tennessee report. Several other local units show a combined water-sewerage figure. Over two-thirds of the local units obtain a per-capita yield of between $8 and $13. There are, however, some local units that are well outside this range. A few municipalities obtain less than $1 and Gatlinburg obtains over $50 per person.

TEXAS(40)

The information on user charges in Texas is based on a 1967 report published by the Texas Municipal League. The League report summarizes data obtained from a survey of 357 municipalities.

Many of the Texas municipalities charge commercial and industrial customers according to a formula that is different from the formula used for residential customers. For residential customers 52 percent of the municipalaties employ a flat rate. Another 40 percent base the levy on the number of fixtures and less than eight percent charge in relation to water use. Flat rates and charges in relation to the number of fixtures are less commonly used, and charges based on water use are more commonly used in assessing commercial and industrial customers. Thirty-nine percent of the municipalities base commercial charges on the number of fixtures. Twenty four percent charge in relation to water use, 22 percent levy flat rates and another 12 percent levy a flat rate that varies with the type of business. The remaining three percent of the local units charge on the basis of number of taps or number of employees. The following table presents the number of municipalities using each form of charge for commercial and residential customers.

The range in flat monthly charges for residential customers is from $.50 in Junction to $3.15 in Port Neeches. The median charge for the 184 municipalities is $1.50 per month. Nearly one-half of these municipalities service customers who reside outside the city. The ratio of inside to outside charges varies from one municipality to another. Many municipalities levy

TABLE 16

1967 SEWERAGE CHARGES IN TEXAS BY NUMBER OF MUNICIPALITIES

Residential

Population	Basis for the Charge Flat Rate	Number of Fixtures	Water Volume	Percentage of Water Bill	Other	Total
Over 25,000	14	17	11	1		43
10,001 - 25,000	32	24	7			63
5,000 - 10,000	28	41	1	1	1	72
Under 5,000	110	60	2	1		173
Total	184	142	21	3	1	351

Commercial*

Population	Basis for the Charge Flat Rate	Number of Fixtures	Water Volume	Percentage of Water Bill	Other	Total
Over 25,000	1	13	20	6	2	42
10,001 - 25,000	6	23	18	7	7	61
5,000 - 10,000	13	38	12	3	3	69
Under 5,000	55	56	13	3	34	161
Total	75	130	63	19	46	333

*No separate commercial schedule or unknown - 18 cities

Source: _Sewer Service in Texas Cities_, Texas Municipal League, Austin, December 1967, P.Viii.

the same charge against both inside and outside customers and the outside rate is less than double the inside rate for nearly all municipalities. One exception is El Paso, which charges $1.50 to inside customers and $6.50 to customers residing outside the city. The monthly rates levied against commercial customers range from $.25 in Fayettsville to $10 in Windcrest. The median charge is $2.50 and the most common charge is $1.50. The range is greatest for the municipalities under 5,000 population but the median for this category is the same as the median for all municipalities.

In addition to the 75 municipalities that charge the same rate to all commercial customers, there are 41 local units that vary the charge by the type of commercial customer. Most of these municipalities are in the smallest population category. The local units generally have from three to seven categories of establishments. The charges do not generally exceed $10 a month for any category except schools and hospitals. Charges for these two categories range up to $25 and $30 in some municipalities.

All of the municipalities that base the charge to residential customers on water use have a minimum levy. The minimum ranges from $.30 to $2 a month. The variable charge takes one of three forms. The most common form is a rate schedule where the rate for additional units of water decreases as the quantity of water increases. A second form is a percentage of the water bill. The third form of charge is a combined water and sewerage charge. This third form of charge is used in Austin but is not common. The three municipalities that charge on the basis of the water bill use three different percentages (25, 50, and 75 percent).

Most of the local units that charge commercial and industrial establishments according to water use also have minimum charges. A few of the large municipalities base the charge on the size of the water meter. In Fort Worth the minimum monthly charge ranges from $.90 for a five-eighths or three-fourths inch meter to $106 for a 10 inch meter. The precentage used by municipalities that base the charge on the water bill ranges from 5 to 80 percent but nearly all the local units use 40 percent or less.

The charge by municipalities that base the levy on water use ranges from $.50 to $4.05 for 5,000 gallons. The median charge is between $1.50 and $2.

All of the municipalities that base residential and commercial charges on the number of fixtures have a minimum monthly charge. The minimum charge for residential customers ranges from $.10 for one fixture in Coleman to $3 for five fixtures in Commerce. The commercial minimum ranges from $.10 to $4. The rate ranges between $.10 and $1 for each fixture above the number included in the minimum. For four fixtures, the charge ranges from $.50 to $4.75 to residential customers and $.55 to $6 for commercial establishments. The residential median is approximately $1.50 and the commercial median $2.

Two municipalities charge commercial customers according to the number of employees and three charge on the basis of the number of taps. Commerce charges $.30 for each two employees, Sulphur Springs charges $.50 for each tap over two and Hughes Springs charges $3 for each tap.

A few of the municipalities have a special charge for industries. The charge varies by type of industry rather than by any measure of the strength of the effluent. For example, Waco charges a higher percentage of the water bill to packing, poultry, and milk plants than to laundries and bottling works. Most municipalities do have ordinances that regulate the wastes that can be discharged into the sewer system. In addition to regulations on specific wastes, some municipalities limit the concentration of grease, suspended solids, and biochemical oxygen demand. Fifty four or 15 percent of the local units require pretreatment of industrial wastes.

Most of the municipalities have fees for permits and sewer connections. Fifty-two local units charge a flat plumbing permit fee and 185 levy a fee that depends on the number of fixtures. The flat fees range from $.50 to $20 and the median is between $2.50 and $4. In municipalities where the number of fixtures enter into the fee, the charge ranges from $.75 to $13 for four fixtures and $1.35 to $24 for 12 fixtures. The tap fee is based on the actual cost in some municipalities. The flat rate charges range from $0 to $85.

The reported revenue obtained from user charges ranged from over $6 million for Dallas to less than $1,000 in some municipalities. In over 90 percent of the municipalities, the revenue from user charges was greater than the operating and maintenance costs of collection and treatment. In Dallas, the revenue was three times the costs and in some municipalities the ratio of revenue to operating and maintenance costs was greater than two to one. The per capita yield ranged from less than $1 to over $30 but most of the municipalities obtained between $5 and $8 per person.

The Texas Report includes the monthly charge levied by 36 municipalities on four dates: 1939, 1950, 1960,1967. The charge is for 5,000 gallons per month. The high, low and median rates are shown for each year in the following table.

TABLE 17

MONTHLY SEWER SERVICE CHARGES BY YEARS IN TEXAS MUNICIPALITIES

	Year			
	1939	1950	1960	1967
High	1.50	1.50	$2.00	$2.25
Median	.50	1.00	1.00	1.25
Low	0	0	0	.68
Most common charge	0	1.00	1.00	1.00

Source: Sewer Service in Texas Cities, Texas Municipal League, Austin, December 1967, Page Vi and Vii.

The table shows that rates have moved steadily upwards. In 1939 only three local units charged more than $1 and 13 had no charge. In 1967 all levied a charge and over twenty charged more than $1. The table does not indicate, however, whether rates have risen as fast as costs.

VIRGINIA(41)

The material on Virginia is taken from a report by the Virginia Municipal League. The information in the report is based on a survey of towns conducted by the League in 1963.

The most commonly used basis for sewer service charges in Virginia towns is a percentage of the water bill. For the 50 towns surveyed, 19 used a percentage of the water bill, 11 used a flat monthly charge, 8 used water volume, 1 charged in relation to the number of fixtures, and 11 had no sewer service charge.

For municipalities that charge in relation to the water bill, the percentage ranges from 20 to 100 percent, and the median is 50 percent. Some of these municipalities also levy a minimum charge. The minimum charge does not exceed $2 per month for any residential customer inside the municipality.

The range for flat rates is $.50 to $2 and the median rate is $1.25. The towns basing the charge on water volume are almost evenly divided between charging a fixed rate per thousand gallons and a declining rate. A typical fixed charge is $.15 per thousand gallons.

The Virginia towns also charge a sewer connection fee. The charge varies from $5 if labor and material are supplied by the customer or $15 if supplied by the town, to $300. The median fee is in the $75-$100 range.

Some of the municipalities levy a higher connection fee and service charge on customers outside the city. This additional charge averages about 33 percent in most cases.

The League study did not include the larger municipalities in its survey. However, some information on these larger municipalities can be gleamed from other sources. For example, Richmond, Roanoke, Harrisonburg, Martinsville, Virginia Beach, and Wytheville use the volume of water or water bill as the basis for their charges. Alexandria, Pulaski, and Winchester use a flat monthly charge.

WASHINGTON

The material on sewerage charges in Washington is taken from a 1964 bulletin published by the University of Washington. The bulletin was sponsored by the Association of Washington Cities in cooperation with the Bureau of Governmental Research and Services.

In general, municipalities in Washington finance lateral extensions through local improvement districts, major trunk lines by a general tax levy or a general obligation bond issue, and treatment and disposal facilities by revenue bonds. The operation and maintenance costs are covered primarily by service and connection charges. This financing system is an attempt to connect local charges with expenditures that yield primarily local benefits, and general charges with the benefits that are essentially general in nature. In keeping with this philosophy, municipalities are allowed to charge a lower rate in areas where the system has been fully amortized than in areas where extensions are being made.

Many of the large municipalities base the user charge on volume of water but the predominant method employed in Washington is a flat monthly charge. Nearly all of the municipalities vary the charge by the number of units in the dwelling. In some cases, the rate per unit is constant and in others it declines after the first unit. Approximately six of the municipalities charge a flat rate to single family dwellings but shift to volume of water for dwellings with multiple units. The monthly charge for a single family residence within the city ranges from $.75 to $5, but nearly all of the municipalities charge between $1 and $3.

The municipalities that charge a flat rate to commercial and industrial customers generally have a detailed schedule of rates. Richland for example has 12 classifications. In addition, some categories like restaurants are further classified according to the number of seats. The monthly charge ranges from $2 for churches, clubs and garages, to $25 for some hotels and motels. The highest rate in most municipalities is charged to schools. In a small number of local units, the charge is based on average daily attendance.

The municipalities that charge in relation to water volume have a minimum charge and a rate schedule that declines with the quantity of water used. The minimum is approximately $200 for most municipalities. For local units that employ a percentage of the water as the method of charging users, the percentage ranges from 35 percent to 80 percent and the median is 75 percent. Spokane and Bellingham base their charge on the size of the water meter. In Bellingham the monthly charge ranges from $1.50 for a three-fourths inch meter to $48 for a 24 inch meter. The following table indicates the number of municipalities employing each charge method, by size of municipality.

Nearly all of the local units charge customers residing outside the municipality more than the inside customers. The amount of the additional levy varies among municipalities but the most common formula employed is a 50 percent surcharge on outside customers.

Municipalities in Washington tend to employ variable connection charges more than municipalities in other States.

Seattle and many other local units make a charge that is equal to the actual cost of the connection and other municipalities charge in relation to number of front feet. Takoma, for example, charges $4.50 per front feet (minimum charge $225).

TABLE 18

1964 Sewerage Charges in Washington by Number of Municipalities

Basis of Charge

Population	Flat Rate	Volume of Water Use	Percentage of Water Bill	Size of Water Meter	Total
Over 100,000		2		1	3
10,001-100,000	9	3	3	1	16
5,001- 10,000	3	1			4
2,501- 5,000	8	3	3		14
1,000- 2,500	17				17
Under 1,000	12				12
Total	49	9	6	2	66

SOURCE: David W. Stevens and Richard A Cornils, Sewer Rates in Washington Cities, Association of Washington Cities in Cooperation with the Bureau of Government Research and Services, Univ., of Wash., Seattle, Inf., Bul. No. 263, November 1964.

WISCONSIN

The description of user charges in Wisconsin is based on a summary of sewer service charges published by the Wisconsin Department of Natural Resources, dated July 1963.

Over two-thirds of the municipalities in Wisconsin base the charge on a percentage of the water bill. For the municipalities with a population that exceed 1,000, over 80 percent charge in relation to the water bill. Although the percentage ranges from 25 percent to 300 percent, most of the municipalities are concentrated around 100 percent. A large majority of the municipalities base the charge on the average of the winter bills or make allowance for sprinkling.

Approximately 25 percent of the municipalities base the user charge on a flat rate. These local units tend to vary the residential rate by the number of housing units in a dwelling. For example, Brookfield charges a monthly rate (most Wisconsin municipalities charge by the quarter) of $4 for a single family and $4 for each additional unit. The rates range from less than $1 to nearly $5 at a monthly rate. The median charge is approximately $3 for a single dwelling. Many municipalities employing a flat charge have a very detailed schedule of rates for commercial customers. The community of Osceola has nine categories and rates range from $.50 per month for churches to $25 for hotel and $35 for a school. A typical municipality has five categories and the rates range from $3 to $10. The highest charge is generally assessed against a school or hospital. In some municipalities this charge exceeds $100 per month. Another variation of the fixed charge is found in Wisconsin. In some municipalities the commercial charge is based on both the type of establishment and the number of employees. Nearly all the municipalities employ either the flat rate or percentage of the water bill methods. However, a few municipalities base the charge on water volume, size of water meter and number of connections. One variation is a minimum charge based on the size of the water meter combined with a variable charge which is related to the volume of water used. For example, Baldwin's minimum ranges from $1.67 (monthly rate) for a 5/8" meter to $28.33 for a 4" meter. The variable charge is from $.10 to $.45 per thousand gallons.

The following table indicates the number of municipalities employing each type of charge. The table is based on the charge made to residential customers. The charge to commercial customers is on the same basis as for residential users in most municipalities. The major difference between commercial and residential users is that the monthly charges are higher and there are more rate categories for commercial customers.

Approximately one-third of the Wisconsin municipalities have special charges for industrial wastes. A few of the local units employ general charges but most municipalities tailor the charge to the specific industry that is connected to the municipal system. The general formulas take the form of a charge per employee as in Maxomanie, a charge per pound of biochemical oxygen demand, as in Fontana, or a charge based on an effluent of greater than normal strength as in Madison. In municipalities where the charge is tailored to an industry, the levy may be a flat rate, or it may be based on water use, number of employees, or output. In Broadhead, cheese factories are assessed $100, cheese packing plants $50, and industries that discharge sanitary effluents only $25. Bertin charges a tanning company by the volume of water used, a brewing company by the number of barrels of beer produced, and a canning company a flat rate plus a percentage of the water bill.

Virtually no information on revenue is given in the Wisconsin summary. However, since the most common charge method is a percentage of the water bill and since the average percentage is higher than for most cities, it is likely that the per capita revenue from sewer charges is higher in Wisconsin than in most other states.

TABLE 19

1963 SEWERAGE CHARGES IN WISCONSIN BY NUMBER OF MUNICIPALITIES

	Basis of Charge			
Population	Flat Rate	Percentage of Water Bill	Other	Total
Over 100,000	1	1		1
10,001 - 100,000		8	2	11
5,001 - 10,000		14	1	15
2,501 - 5,000	3	22	1	26
1,001 - 2,500	11	41	6	58
Under 1,000	27	30	1	58
Total	42	116	11	169

Source: Summary of Sewer Service Charge in Wisconsin, July 1963, Wisconsin Department of Natural Resources, Division of Environmental Projection, 1963.

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